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[1] On March 1, 1948, Dr. C. L. Lundell resigned as Professor of Botany and Director of the University Herbarium of Southern Methodist University to devote full time to his duties as Director and Head Botanist of the Texas Research Foundation. He had served in his position at Southern Methodist University on a dollar a year basis since July 1, 1946, the date the Foundation became an independent non-profit research and educational institution, chartered by the State of Texas.

The Lundell Herbarium, which had been deposited on loan at Southern Methodist University, was transferred to the Texas Research Foundation at Renner in 1948. Comprising principally tropical American collections of the Lundells, Percy H. Gentle, Eizi Matuda, and George B. Hinton, it contains types or isotypes of most of the species described by Lundell. This herbarium contains approximately 25,000 specimens from Texas, Mexico, and Central America, and about 5,000 specimens from other areas. Aside from the strictly tropical groups, grasses are being given primary consideration in the development of the collection.

With the withdrawal of the Lundell Herbarium, the University Herbarium of Southern Methodist University is largely restricted to collections from temperate North America, with Texas specimens predominating. On July 1, 1949, Dr. Lloyd H. Shinners was appointed Director of the University Herbarium.

All communications regarding exchanges with the Lundell Herbarium, as well as requests for loans, should be sent to the Texas Research Foundation, P. O. Box 43, Renner, Texas.

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CYRUS LONGWORTH LUNDELL

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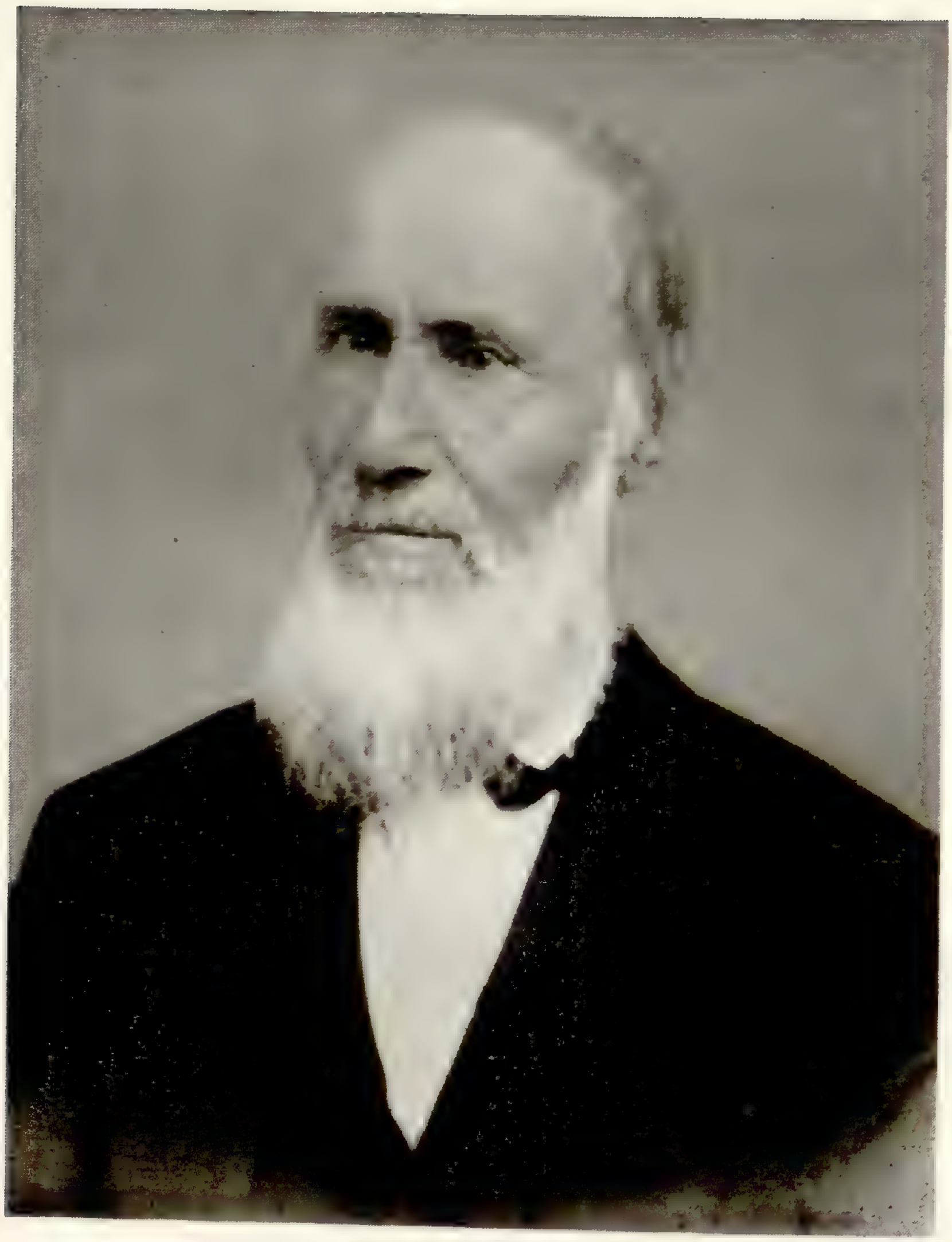

CHARLES WRIGHT

Dedicated to the Memory
of
CHARLES WRIGHT
1811-1885
Pioneer Botanical Explorer

WRIGHTIA

VOLUME 1 AUGUST, 1945 NUMBER 1

THE GENUS GARCIA VAHL, A POTENTIAL SOURCE OF SUPERIOR HARD QUICK-DRYING OIL

CYRUS LONGWORTH LUNDELL

INTRODUCTION

Among the host of tropical American plants yielding products long utilized by the natives for medicinal purposes is *Garcia nutans* Vahl. In Mexico the seeds of this tree are locally employed as a purgative. According to reports, the purgative action resembles that of castor oil which is obtained from the seeds of *Ricinus communis* L.

In the wartime search for new vegetable oils undertaken by the U. S. Government, seeds of *G. nutans* were gathered in Mexico and sent to laboratories in the United States for examination. The first published report, issued by Gardner and Westgate[1], indicated that the seeds are a potential source of a new superior, hard, quick-drying oil.

Shortly after the analyses of the seeds were obtained in 1943, a survey was organized by the Board of Economic Warfare under the direction of the writer to determine the extent of the native stands of the species in Mexico and Central America. Although reports made locally in Mexico City indicated that a large supply of seeds could be readily obtained, these were unfounded.

The first native stand of *G. nutans* was discovered on July 14, 1943, near Pujal in eastern San Luis Potosí. Subsequent surveys extended the range south of Tamazunchale. Throughout the area, the tree grows in abundance on alluvium along streams with the densest stands observed in the vicinity of Huichihuayan.

Through survey parties, inquiries, and an examination of records of the species in American herbaria, attempts were made to locate additional native stands. The search has been futile.

Although *G. nutans* is known from widely separated parts of tropical America, and was originally described from South America, an examination of data on specimens and published reports indicate that a high percentage, if not all, of the collections outside of eastern Mexico were made either

[1] Gardner, H. A. and M. W. Westgate. National Paint, Varnish and Lacquer Association, Inc. Scientific Section, Circ. 662: 173–178. 1943.

from cultivated trees or from trees growing in or around inhabited places. Even the type was taken from a solitary evidently introduced tree growing at Santa Marta, Colombia.

Since no stands of the tree have been found elsewhere, the evident conclusion is that *G. nutans* is native to eastern Mexico, and that the scattered trees found throughout tropical America are the result of introductions and naturalization. Seeds with purgative and other medicinal properties, long used by the natives, are widely distributed by dealers in medicinal plant material (yerberos) in their extensive commerce. Hence the sporadic distribution of the species can be accounted for through this channel.

During the survey, Charles L. Gilly, Sr., and Efraim Hernandez Xolocotzi of the staff of the Board of Economic Warfare (now the Foreign Economic Administration), discovered an undescribed species of *Garcia* in northern Tabasco, further evidence that the species of the genus are endemic to Mexico.

In this study, the specimens cited are in the herbaria of the Arnold Arboretum of Harvard University, University of Michigan, New York Botanical Garden, and Southern Methodist University. Acknowledgment is made to Dr. A. C. Smith of the Arnold Arboretum for his cooperation in supplying a copy of the original description of *G. nutans* along with a sketch of the original plate.

TAXONOMY OF THE GENUS

GARCIA Vahl in Rohr, Skrivt. Naturh. Selsk. (Kjoebenhavn) 2: 217, *pl. 9.* 1792; Benth. & Hook. f., Gen. Pl. 3: 292. 1880.

Shrubs or small trees up to 15 m. high, 35 cm. in diameter. Leaves alternate, petiolate, penninerved, entire. Flowers monoecious, unisexual, usually with 1 pistillate and several staminate borne at the apex of a twig. Staminate flowers: calyx rupturing irregularly into 2 or more valvate segments, persistent; petals 6–13, narrow, long villous within, appressed hirsute on the outer surface, pink to deep maroon, longer than calyx; stamens numerous, borne on a pilose, glandular receptacle; filaments free; rudimentary ovary absent. Pistillate flowers: calyx as in staminate flowers, caducous; petals as in staminate flowers; disk glandular, deeply lobed; ovary 3-celled; style short, stout; stigma lobed, laminated, fleshy, usually deep maroon; ovules solitary in the cells. Capsules usually deeply 3-lobed, 3-seeded. Seeds globose, without caruncle.

The original description of the genus appears in a paper entitled "Plantae-Slaegter beskrevne af Hr. Oberst-Lieutenant von Rohr, med tilfoide Anmaerkninger af Hr. Professor Vahl." In this paper, most of the generic descriptions (in larger type) are signed by Rohr, and most of the specific (in smaller type) by Vahl. However, the name "Vahl" appears at the end of the description of *G. nutans*, and he must be considered the author of both the genus and the species.

Type species: *G. nutans* Vahl.

1280 2567

Glands in staminate flowers distributed over the entire surface of the receptacle; petals 10–17 mm. long; stamens 63–160; ovary very conspicuous ..... 1. *G. nutans.*

Glands in staminate flowers present only in an outer series on the receptacle; petals 5.5. mm. long; stamens 29; ovary minute..... 2. *G. pariflora.*

1. GARCIA NUTANS Vahl in Rohr, Skrivt. Naturh. Selsk. (Kjoebenhavn) 2: 217, *pl. 9.* 1792; Pax in Engler, Pflanzenr. IV. 147: 14. 1910; Standl., Contr. U. S. Nat. Herb. 23: 620. 1923. Fig. 1, a-g.

Garcia Mayana Britton, Sci. Surv. Porto Rico & Virgin Isl. 6: 357. 1926.

An evergreen shrub or small tree, up to 15 m. high, 35 cm. in diameter; twigs striate-angled, rather slender, sparsely appressed hispidulous to densely fulvous-tomentulose. Leaves petiolate, the petioles slender, 1–5 cm. long, essentially glabrous to fulvous-tomentulose; leaf blades paler on undersurface, membranaceous to subcoriaceous, oblong, oblong-elliptic, elliptic, oblanceolate-elliptic or obovate-elliptic, 8–19 cm. long, rarely smaller, 2.5–7 cm. wide, apex abruptly acuminate to obtuse, the acumen acutish to obtuse, usually short, base usually obtuse, sometimes rounded, midvein slightly elevated above, prominent on undersurface, primary veins 7–10 on each side, conspicuous, glabrous on upper surface except for occasional scattered hairs along the midvein, varying from densely soft pilose to sparsely subappressed hispidulous on lower surface. Flowers monoecious, usually with 1, sometimes with 2, pistillate flowers borne terminally on a twig, these subtended by several staminate flowers in various stages of development. Staminate flowers borne on slender peduncles 1–3.7 cm. long, the peduncles sparsely subappressed hispidulous to densely fulvous-tomentulose; calyx 6–13.5 mm. long, opening irregularly, fulvous-tomentulose externally, glabrous within except at apex; petals 6–13, linear, linear-oblong or oblong-elliptic, variable in size in flowers from the same tree, 10–17 mm. long, 2–5.5 mm. wide, apex subulate-acuminate, base attenuate, externally densely hirsute with long straight appressed hairs, the inner surface usually villous with long hairs, but sometimes nearly glabrous, pinkish to dark red; receptacle pilose, bearing between the filaments numerous lanceolate to clavate glands up to 1.5 mm. long; stamens numerous, 63–160; filaments glabrous or bearing a few scattered long straggly hairs, minutely granulose, 2.4–6 mm. long; anthers apiculate, 0.7–1 mm. long. Pistillate flowers: peduncles 1–3 cm. long, tomentulose; calyx 8–9 mm. long, tomentulose externally; petals linear, oblong-elliptic or elliptic, 11–13 mm. long, 3–6.5 mm. wide, apex abruptly cuspidate, villous within, hirsute on outer surface with long appressed hairs; glandular disk lobed, about 2 mm. high; ovary 3-celled, densely fulvous-tomentulose; style thick, 1.5–2 mm. long; stigma large, laminated, lobed, fleshy, black-purple to deep maroon. Capsules usually 3-lobed, 3-seeded, 2–2.5 cm. high, 3–4 cm. in diameter, fulvous-tomentulose, elastically dehiscent. Seeds globose, up to 1.7 cm. in diameter.

MEXICO: SAN LUIS POTOSÍ, Finca de Porfirio Castellanos, 4 kilometers east of Pujal, on alluvial soil, July 14, 1943, *C. L. Lundell 12241*, tree, 6 in.

diameter, petals reddish, stigma black-purple; same locality and date, *Lundell 12242*, tree, 4 in. diameter, petals reddish, stigma black-purple; Huichihuayan, along brook, July 15, 1943, *Lundell 12247*, small tree, 9–12 ft. high, corolla reddish; same locality and date, on river bank, *Lundell 12248*, tree, 8 in. diameter, 30 ft. high, petals dark red; same locality and date, *Lundell 12249*, tree, 8 in. diameter, 35 ft. high, petals dark red; between Huichihuayan and Tamazunchale, in forest, July 15, 1943, *Lundell 12250*, tree, 2 in. diameter, 12 ft. high, petals dark red; south of Tamazunchale, alt. 500 ft., along ravine, *Lundell 12255*, small tree, petals dark red, stigma maroon; 2 kilometers north of Huichihuayan, alt. 400 ft., in virgin forest, July 16, 1943, *Stephen S. White 5060*, slender tree, 8 ft. high; same locality and date, *White 5063*, tree, 8 in. diameter, 25 ft. high; between Tamazunchale and Valles, kilometer 401, on bank of Axtla River, Aug. 21, 1943, *C. L. Lundell & Amelia A. Lundell 12424*, tree, 3 in. diameter, 12 ft. high; Huichihuayan, kilometer 409, on river bank, Aug. 21, 1943, *Lundell & Lundell 12429*, tree, 5 in. diameter, 27 ft. high, petals reddish; Huichihuayan, kilometer 403.5, on river bank, Nov. 5, 1943, *Lundell & Lundell 12653*, small tree, petals reddish; Huichihuayan, on river bank, Nov. 5, 1943, *Lundell & Lundell 12655*, small tree, petals reddish; Taman, about 15 kilometers southwest of Tamazunchale, along highway, at base of steep bank of small stream, April 16, 1944, *Efraim Hernandez Xolocotzi 164*, shrub. CHIAPAS, Escuintla, Dec. 17, 1937, *Eizi Matuda 2061;* same locality, alt. 160 m., July, 1938, *Matuda 2619*, tree in plaza, 3 m. high, 15 cm. diameter. TABASCO, Boca del Cerro, near Tenosique, Usumacintla River, riverside, July 1–5, 1939, *Matuda 3568*, tree, 10 m. high, 35 cm. diameter. YUCATAN, Chichen Itza, edge of Dzadz Aguada, June 25, 1932, *W. C. Steere 1569*, tree. PUERTO RICO: Mayaguez, planted in Agricultural Experiment Station, Mar. 10, 1925, *N. L. Britton & Kenneth R. Boynton 8331* (type of *G. Mayana* Britton), tree, 12 m. high, flowers pinkish. GUADELOUPE: Jardin d'Essais de Pointe à Pitre, July 15, 1936, *H. Stehlé 403*, introduced and naturalized tree, 15 m. high. TRINIDAD: Botanic Gardens, planted, Nov. 8, 1933, *W. E. Broadway 9283*, a small but an aged tree, fruits abundantly. COLOMBIA: Dept. Bolivar, vicinity of Turbaco, alt. 200–300 m., in thicket, Nov. 6–22, 1926, *E P. Killip & A. C. Smith 14327*, shrub, 12–15 ft., petals pink, stamens red; Torrecilla, near Turbaco, alt. 150–300 m., on limestone soil in dense woods, Nov. 7–19, 1926, *Killip & Smith 14679*, tree, 30–40 ft., fruit 3-celled.

Vernacular names: "cuatlaguilocuatl," "tlacualote texixtl," "piñon," "piñoncillo," "huevo de gato," "avellano," "pascualito," "pepita del indio."

Recorded by Xolocotzi from Tamazunchale, San Luis Potosí, the first two vernacular names are Indian and these are significant for they indicate endemism of the tree. All of the other names are Spanish, and widely applied to various plants with similar fruits.

In eastern San Luis Potosí, the variation in *G. nutans* is considerable. In pubescence the leaves range from essentially glabrous to densely pilose on the undersurface. As a character of taxonomic significance, flower size is of minor importance, for the extremes in the species, large and small, may be found on a single tree.

G. Mayana Britton represents the phase of the species with leaves pilose on the undersurface. In the large series of specimens from the vicinity of

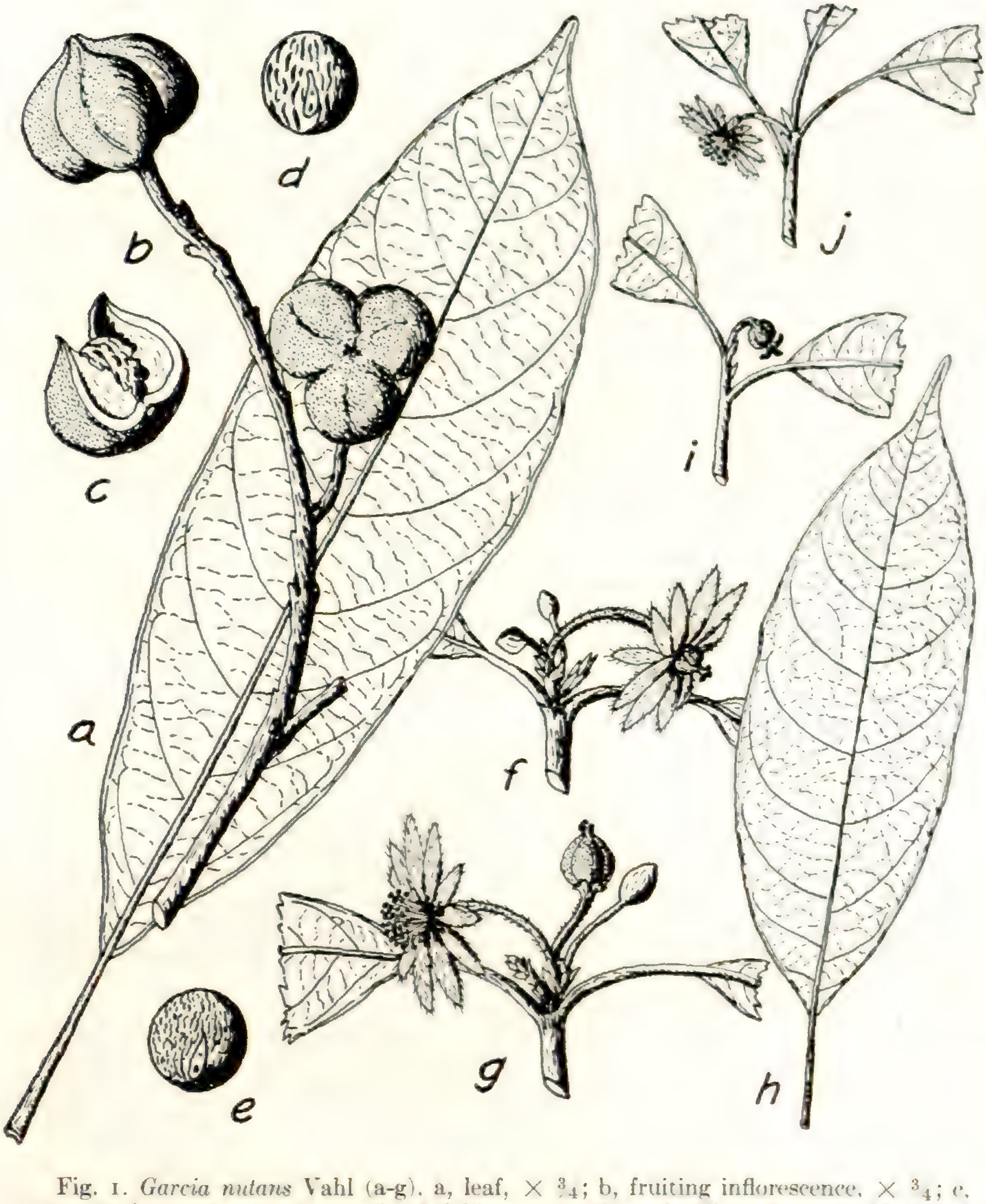

Fig. 1. *Garcia nutans* Vahl (a-g). a, leaf, × ¾; b, fruiting inflorescence, × ¾; c, segment of capsule, showing mode of dehiscence, with seed still in place, × ¾; d and e, seeds, showing various types of mottling on surface, × 1; f, pistillate flower (note buds of two staminate flowers), × 1; g, staminate flower (note that calyx segments and petals have fallen from pistillate flower and that ovary has started to develop), × 1. *Garcia parviflora* Lundell (h-j). h, leaf, × ¾; i, pistillate flower after calyx segments and petals have dropped, in approximately same stage of development as that in *g*, × 1; j, staminate flower, × 1. a-e, drawn from *Efraim Hernandez Xolocotzi 164;* f-g, drawn from *C. L. Lundell & Amelia A. Lundell 12429;* h-j, drawn from *Charles L. Gilly, Sr. & Xolocotzi 297*. Illustrated by Charles L. Gilly, Sr.

Huichihuayan, all of the variations found in specimens from the West Indies and South America are evident, and these do not appear to be sufficiently stable to warrant formal varietal recognition.

2. **Garcia parviflora** Lundell, sp. nov. Fig. 1, h-j.

Arbor parva, 2.5–4 m. alta, ramulis gracilibus, novellis adpresse pubescentibus. Folia longe petiolata, membranacea, oblonga, oblongo-elliptica vel oblanceolato-oblonga, 10–16.5 cm. longa, 3–5.8 cm. lata, apice abrupte cuspidato-acuminata, basi obtusa vel rotundata, subglabra. Flores ♂ pedunculati, 1.3 diam.; calyx 4 mm. longus; petala 6, lineari-oblonga, 5.5 mm. longa, 1.6 mm. lata, subabrupte acuminata, intus villosa, extus adpresse hirsuta; stamina 29; filamenta glabra. Flores ♀ pedunculati; ovarium 3-loculare, 2.5 mm. longum, hirsutum.

Small tree, 2.5–4 m. high, 3–9 cm. in diameter; twigs slender, at first densely appressed hispidulous with short curved hairs, drying brown, striate-angled. Leaves with slender petioles 2–5 cm. long, the petioles appressed hispidulous at first, the hairs densest at base and apex; leaf blades membranaceous, dark green above, paler on lower surface, oblong, oblong-elliptic or oblanceolate-oblong, 10–16.5 cm. long, 3–5.8 cm. wide, apex abruptly cuspidate-acuminate, the cusp often obtusish, base obtuse or rounded, midvein slightly elevated on upper surface, prominent on undersurface, primary veins 8–10 on each side, slender but conspicuous, anastomosing submarginally, the secondary veins openly reticulate, margin entire, slightly wavy, at first sparsely appressed hispidulous with short hairs on midvein above, and along veins on undersurface. Flowers monoecious. Staminate flowers borne on slender appressed hispidulous peduncles 7 mm. long; calyx 4 mm. long, sparsely appressed hispidulous; petals 6, rose-pink, linear-oblong, 5.5 mm. long, 1.6 mm. wide, subabruptly acuminate, short subulate, densely villous on inner surface with long hairs, appressed hairy on the outer surface with long hairs; receptacle pubescent, bearing few small glands in an outer series; stamens 29; filaments stout, 2–2.5 mm. long, smooth; anthers 2-celled, broadly cordate, about 0.6 mm. long, inconspicuously apiculate. Pistillate flowers borne on slender appressed hispidulous peduncles 1.2 cm. long; calyx and corolla not seen; ovary hirsute, 3-celled, 2.5 mm. long; stigma lobed, laminated; fruits unknown.

MEXICO: TABASCO, on limestone ridge just north of Cerro de Azufre, about 5 kilometers southwest of Teapa, in rain forest, alt. 100–150 m., September 20, 1944, *Charles L. Gilly, Sr. & Efraim Hernandez Xolocotzi 297* (type in the herbarium of Southern Methodist University), small tree, 2.5 m. tall, 3 cm. diameter, staminate flowers 1.3 cm. wide; same locality and date, *Gilly & Xolocotzi 304*, tree 4 m. tall, 9 cm. diameter.

Although closely resembling *G. nutans*, the thin membranaceous leaves abruptly cuspidate-acuminate, the slender short peduncles, the small flowers only 1.3 cm. in diameter, the rose-pink petals only 5.5 mm. long, the few stamens (29), and the small ovary distinguish the species. In *G. nutans* glands are present over the surface of the entire receptacle, distributed among the filaments. In *G. parviflora* glands are present on the

receptacle only in an outer series. The new species evidently represents a localized form in which a reduction in the size and number of the floral parts has taken place.

Since no seeds have been available for analyses, nothing is known regarding the possible economic value of the oil from this species.

CHARACTERISTICS AND PHYSICAL PROPERTIES OF GARCIA OIL

The genus *Garcia* is closely related botanically to the genus *Aleurites*, the source of tung oil. Both are referable to the JATROPHEAE. Although botanical affinity does not necessarily mean that the oil of seeds from species of two genera would have similar properties, the preliminary analyses indicate that *Garcia* oil and tung oil are much alike in various characteristics and properties.

Since the availability of the publication containing the analyses of *Garcia* oil is limited, the following data have been abstracted from the report by Gardner and Westgate (*l.c.*).

"The first step in the investigation was to shell the nuts and heat-press the kernels to obtain sufficient oil for examination. The shell was very thin and brittle and easily removable. The oil was easily expressed, was very pale, and resembled in appearance American tung oil. The oil was examined for its characteristics and its physical properties.

Table 1

CHARACTERISTICS OF GARCIA NUTANS

CHARACTERISTIC	U. S. D. A. LABORATORY	THIS LABORATORY
SEED		
Per cent Kernel	80.52	78.7
Per cent Shell	19.48	21.3
KERNEL		
Per cent Oil	53.76	56.7
Per cent Moisture	2.90	.....
OIL		
Refractive Index (25° C.)		
Hot Pressed Oil from Kernel	1.5260	1.5254
Solvent Extracted Oil from Pomace	.....	1.5251
Solvent Extracted Oil from Kernel	.....	1.5250
Specific Gravity (15.5° 15.5° C.)	.....	0.9420
Saponification Number	192.4	189.2
Acid Number (Alcohol-Benzol)	.....	1.1
Unsaponifiable Matter (per cent)	.....	0.76
Iodine Number (Wijs, 1 hr.)	176.8	177.9
Diene Value (Ellis-Jones)	81.50	.....
Carbonyl Value (Leith)	0.0	.....
Hexabromide Test	Negative	.....

"A study of these characteristics is of considerable interest. In the first place, the nut contains a very high percentage (80%) of kernel. The kernel contains in the neighborhood of 55% oil, approximately that of tung kernel. It will be noted in Table 1 that the refractive index of the oil is very high (1.525)—substantially higher than that of American tung oil (1.517). This is true not only of the hot-pressed oil but of solvent-extracted oil from the pomace or directly from the kernel. The specific gravity is of the same order as that of tung oil. The acidity is very low, approaching that of American tung oil. The unsaponifiable matter is normal for vegetable drying oils, and the iodine value is higher than that of American tung oil. The very high diene value, the negligible carbonyl value, and the negative hexabromide test indicate that the oil is highly unsaturated but that it contains no licanic or linolenic acids. Indications from the analytical determinations are that the oil might consist almost entirely of elaeostearic glycerides. In Table 1 it will be noted that an analysis of the nuts recently made by the laboratories of the Bureau of Agricultural Chemistry and Engineering, Department of Agriculture, Washington, gave results very similar to those obtained at this laboratory.

Table 2

PHYSICAL TESTS ON EXPRESSED OIL FROM GARCIA NUTANS

TEST	OBSERVATION
Color (Gardner Tubes)	4
Viscosity (Gardner Tubes)	Between J and K
Heat-Bodying (Browne Apparatus)	
282° down to 225° C. in 5 minutes	S
282° down to 175° C. in 21 "	X
282° down to 100° C. in 60 "	Y
Gelatin Time (Browne Heat Test)	7 min., 45 sec.
Drying Time	
Without driers	Under 18 hours
With 0.5% Pb, 0.05% Co driers added	" 3 "
Nature of Film on Glass	Frosted and wrinkled

"The next step in the investigation was to determine some of the physical properties, and these are presented in Table 2. The purpose of the heat bodying tests was to determine the bodying effects of heat, which might possibly simulate those of kettle processing. The Browne heat test apparatus was used to secure a set of standard conditions. The oil bath was brought to a temperature of 282° C., the flame was removed, and immediately comparative 5 ml. samples of the *Garcia nutans* oil and of the American tung oil were placed in test tubes and suspended in the oil bath until a definite lower temperature was reached. The time necessary to secure this temperature difference was noted. The process was repeated for lower temperatures. The test tubes containing the bodied oils were then cooled and the viscosities determined. The viscosities of the bodied oils obtained by this treatment were S, X, and Y for *Garcia nutans* oil, as compared to M, U, and V for pure American tung oil. The much greater speed of bodying of the *Garcia nutans* oil was apparent, thus indicating that this oil, even in the presence of softer oils such as linseed oil, could be used to obtain quick bodying varnish.

"Samples of the two oils were heated to 282° C. until gelatinization took

place, and the solid polymerized masses examined. That of *Garcia nutans* oil seemed to be somewhat firmer than that of tung oil. Also *Garcia nutans* oil polymerized to a solid in less than 8 minutes as compared to 12 minutes for American tung oil.

"Varnishes were then prepared with the *Garcia nutans* oil, using a modified phenolic resin. The resin and the oil were heated quickly together for about 10 minutes to a temperature of 250° C., and held at that temperature for another 10 to 15 minutes. Good string and body were obtained, and the varnishes were thinned to about 60% non-volatile. It was found, however, that better results were obtained when the varnish was thinned to a 50% non-volatile content. The thinner varnish dried within a period of one to two hours, with the production of clear films. After aging overnight, a flowed-out film of this varnish could be immersed in boiling water for one hour, followed by cold water for 150 hours, without showing any blushing effects.

"As a matter of general interest, there was included in this investigation of physical properties the effects of different chemicals upon the oil. For instance, it is well known that tung oil may be gelatinized almost immediately by the addition of stannic chloride in the cold. It was found that *Garcia nutans* oil gave almost the same reaction, resulting in possibly an even firmer mass.

"Samples of *Garcia nutans* and of American tung oils were treated with a solution of a few drops of iodine dissolved in mineral spirits. These were placed in front of an ultraviolet lamp for a few minutes, and then allowed to stand in the laboratory for a few hours. Both samples were changed to a solid white opaque mass, indicating the formation of beta elaeostearin.

"The rates of saponification of these two oils in alcoholic potassium hydroxide were very different. It took at least five times as long to saponify completely the *Garcia nutans* oil as it did the American tung oil. This would suggest its use for varnishes of high alkali resistance.

"The appearance, size and shape of the *Garcia nutans* nuts resembled very closely that of Japanese tung oil nuts which were investigated by the Scientific Section in November, 1921 (see Scientific Circular 138). It would appear, however, that the oil from the nut of *Garcia nutans* is far superior to that from the nut of the Japanese tung oil tree (*Aleurites cordata*). As a matter of fact, it appears to be even much superior to oil from the nut of the tung oil tree (*Aleurites Fordii*).

"A comparison of the properties of Japanese tung oil, as reported upon in Scientific Section Circular 138 referred to above, with those of *Garcia nutans* oil, is of interest. For instance, the Japanese tung oil has an iodine value of about 150 and a refractive index of only 1.4891. It is a much softer oil than Chinese tung oil and can be heat-treated for a longer period of time without the formation of as viscous a product and without any great danger of gelatinization. In other words, Japanese tung oil is much less satisfactory than Chinese tung oil as a varnish making material. These data are included here to point out the differences between Japanese tung oil and *Garcia nutans* oil, because at first glance the appearance of the seed of the latter product seemed much like that of Japanese tung oil seed.

"In conclusion, it would appear that the seed of *Garcia nutans* should receive immediate consideration by agricultural experts to determine whether plantings, made under proper climatic conditions, could develop quickly an available source of this oil which appears to be very valuable for the manufacture of protective coatings."

A further report on subsequent studies of the oil from seeds of *Garcia nutans* has been made by Westgate[2] in which the following additional data are presented.

"The investigation of this oil, as reported in Scientific Section Circular 662, has been supplemented with additional tests of a control nature. It was found that the oil in thin films dried on glass somewhat more rapidly and more firmly than American tung oil treated in a similar fashion, with or without driers. Comparative varnishes were made with these two oils, and it was again found that *Garcia nutans* oil conferred much more body in the same cooking time than did tung oil. This was true even when 50% of either of these oils in a varnish was replaced by heavy bodied soybean oil. It would appear, therefore, that on a laboratory basis the preliminary optimistic report to the varnish industry on the quality of *Garcia nutans* oil, which was contained in Scientific Circular 662, has been amply confirmed."

POSSIBILITIES FOR COMMERCIALLY EXPLOITING GARCIA NUTANS

The only known wild stands of *G. nutans* occur in eastern San Luis Potosí in the region extending from Valles to Tamazunchale. The extension of the stands from Tamazunchale into Veracruz appears probable, for the species has been collected in the northern part of that state.

G. nutans in this sector occurs principally on heavy alluvial soils along streams and dry stream beds at an altitude of less than 300 meters above sea level. All of the area in which the species has been found is covered with secondary vegetation, for the virgin forest has been felled from time to time for agricultural use. Where the forest has been cleared recently and abandoned, the species forms local thickets. Trees up to 20 centimeters in diameter and 12 meters high were found along the river near Huichihuayan. The Huastecan Indians report that the tree reaches a diameter of 45 centimeters in old forest.

Along the river at Huichihuayan, seedlings and stump sprouts are abundant. Some of the seedlings, not over three years old, were in flower in August, 1943.

Since the widespread clearing of the alluvial lands for agriculture has decimated the wild stand of *G. nutans*, the available crop of seeds for commercial purposes is very limited. A liberal estimate is that not more than 10 long tons of seeds can be obtained annually from the native stands in eastern San Luis Potosí.

The seeds which can be gathered from San Luis Potosí should be adequate to permit experimental tests of the oil on a pilot plant basis. Until the results of initial laboratory experiments have been confirmed by adequate commercial tests, no large scale plantings of the tree can be recommended.

In order to obtain an estimate of the potential yield of seeds, a count was made of all the young fruits on a mature tree in the riparian forest at Huichihuayan. Since the dry weather in the summer of 1943 had caused

[2] Westgate, M. W. National Paint, Varnish and Lacquer Association, Inc. Scientific Section, Circ. 672: 129–132. 1944.

the shedding of many flowers, a count was also made of all twigs which would bear fruits in a favorable season. Since the inflorescence of *G. nutans* consists of one, rarely two, pistillate flowers subtended by several staminate flowers, usually only one capsule with three seeds is to be found on a twig.

The tree selected measured 12.5 centimeters in diameter and 9 meters tall. On the basis of the annual rings, a doubtful method for determining age in the tropics, the tree appeared to be approximately 25 years old. There was a total of 1762 twigs capable of bearing fruits. Due to the dry summer in 1943, only 203 twigs bore young capsules in August from the July flowering period. Typical of the reaction of many plants of semi-arid regions, flowering is determined to a high degree by moisture conditions. In the fall of 1943, all of the *Garcia* trees in the vicinity of the one felled flowered again; hence, the count of 203 for the tree is not indicative of its potential yield that year, for the set of fruits from the second flowering was considerable on other trees.

In plantation culture, the spacing of trees 3 meters apart would give a stand of about 441 trees per acre. On the basis of the twig count from the mature tree growing under forest conditions at Huichihuayan, with all twigs bearing capsules, the potential maximum production would be 2697 kilograms (5946 pounds) of seeds per acre in favorable years.

This calculation is based upon the potential yield of only a single wild tree under competitive forest conditions. The yield from cultivated trees should be higher.

The fruits mature in April and May at which time the seeds are distributed by the elastically dehiscent capsules. Under plantation culture, trees should begin to yield a limited harvest within three years.

As recorded on herbarium specimens of *G. nutans*, the species has been planted in Puerto Rico, Guadeloupe, and Trinidad in experimental gardens. In all places it has borne fruits, and Broadway makes the following notation on the label of his collection from Trinidad: "fruits abundantly." The species appears to be adapted to cultivation over a large part of the lowlands of tropical America.

From seeds obtained in Mexico by H. A. Gardner and sent to the Sub-Tropical Experiment Station at Homestead, Florida, test plantings were made in Florida in 1943 by S. J. Lynch (Westgate *l.c.*). Seed germination was better than 95 per cent, producing vigorous rapidly-growing seedlings. These seedlings have been set out in Florida and in the Lower Rio Grande Valley of Texas.

From seeds obtained in San Luis Potosí in 1943, a test planting was made at the Agricultural Research Station of the Institute of Technology and Plant Industry at Dallas on March 17, 1944. At the same time, other seeds were planted in the greenhouse on the campus of Southern Methodist University. Although the germination was excellent, as in the Florida planting, the cotyledons were not able to throw off the hard seed coat under the dry open field conditions, resulting in a stand of only 20 per cent. Since the species is a forest tree where seeds germinate in moist conditions,

growers must avoid open field plantings unless adequate shade and water can be supplied.

G. nutans is not hardy, for the frost of November 27, 1944, at Dallas, when the temperature dropped to 29° F., killed all of the plants not protected. Under greenhouse conditions, the seedlings thrive. From seeds planted in the greenhouse at Dallas in March, 1944, seedlings had reached a height of over 1 meter on May 17, 1945. One of the seedlings, 14 months old, flowered in May, 1945.

Since the species is not hardy as far north as Dallas, test plantings are being made along the Gulf Coast of Texas. The seedlings in the plot at McAllen, Texas, have made excellent growth showing no setback during the mild winter.

If commercial planting of *G. nutans* prove to be feasible, the sector between Mante and Tamazunchale in eastern Mexico, where ample river water is available for irrigation, appears to be favorable for plantations. Puerto Rico, Cuba, and other similar tropical areas should prove equally well adapted to its culture.

SUMMARY

1. From preliminary investigations, *G. nutans* appears to be endemic in eastern Mexico, for the only known wild stands of the species occur in the region between Valles and Tamazunchale, San Luis Potosí.

2. The genus *Garcia*, closely related botanically to the Asiatic genus *Aleurites*, the source of tung oil, contains two species native to Mexico, *G. nutans* and *G. parviflora*. Only *G. nutans* is at present known to bear seeds of potential commercial value as a source of quick-drying oil.

3. Initial laboratory tests indicate that *Garcia* oil has characteristics and physical properties similar to those of tung oil. In some ways, it appears to be equal, if not superior, to the best tung oil of commerce.

4. Pilot plant tests are necessary to demonstrate that *Garcia* oil is as valuable commercially as laboratory results indicate.

5. The known wild stands of *G. nutans* are estimated to have a potential production of not more than 10 long tons of seeds annually.

6. The cultivation of the tree on a plantation basis will be necessary to obtain substantial commercial quantities of the oil. Initial estimates, based upon a study of wild trees under competitive forest conditions, indicate a low yield. However, through cultivation it should be possible to substantially increase the per acre production of seeds.

7. In test plantings in Florida and Texas, seedlings have made vigorous growth, some flowering within 14 months.

8. The tree is widely adapted to the lowlands of tropical America. The area in eastern Mexico between Mante and Tamazunchale is suggested as the most favorable locality for growers to make test plantings on a commercial scale.

THE GENUS TRIODANIS RAFINESQUE, AND ITS RELATIONSHIPS TO SPECULARIA AND CAMPANULA

ROGERS MCVAUGH

INTRODUCTION

The genus *Specularia* (CAMPANULACEAE) has been more or less generally accepted by botanists only since the publication of Alphonse DeCandolle's *Monographie des Campanulées* in 1830, although the name was proposed in 1748 by Heister for the European plant which, as DeCandolle said, "vulgo in omnibus linguis et omni tempore *Speculum Veneris* dicta fuit." Although four American and at least four European species are currently referred to *Specularia*, no critical evaluation of the generic or specific limits in the group has been published since the work of DeCandolle. Study of American material shows that at least 3 species remain undescribed, and since various workers have cast doubt upon the generic standing of the group as distinct from *Campanula*, it has seemed best to examine all the supposed species of *Specularia* before proposing additions to a genus of somewhat doubtful standing. The relationship between *Specularia Speculum-Veneris* (L.) A.DC. (the type species of the genus) and most of the other species is not a particularly close one, and apparently the biological status of all the species concerned may best be expressed by the grouping of all the American species and at least one European into another genus, *Triodanis* Raf. *Specularia* as properly applied and restricted then comprises but 2 species, both European. At least a part of *Specularia* as currently interpreted is probably best returned to *Campanula*. These conclusions are set forth after examination of the generic lines in the entire CAMPANULINAE, the subtribe to which the above genera belong.

The CAMPANULACEAE proper (CAMPANULACEAE-CAMPANULOIDEAE) are traditionally and apparently justifiably divided into two principal groups of genera distinguished by the manner of dehiscence of the fruit. In the first of these, CAMPANULINAE, the fruit is a capsule opening by lateral pores, and there is a clear distinction between these plants and the WAHLENBERGINAE, in which the capsule is apically dehiscent. Within the CAMPANULINAE, however, generic lines are exceedingly difficult to draw; 7–10 genera have been recognized by most conservative workers, but some of these owe their continued existence perhaps rather to tradition than to biological discontinuity. Most of the several hundred species of the subtribe are customarily assigned to the genus *Campanula*, which is thus made to include a very great variety of forms; this inclusive genus may be regarded as a diverse assemblage of species from which no one has been

able to segregate any additional plausible genera, or the traditional genera may be thought of as small groups split off, with varying degrees of justification, from the great *Campanula* complex. This was recognized by DeCandolle (1830, p. 43) and by Buser (1894, p. 508). Similar phenomena are familiar to students of all groups of plants involving large genera.

Both *Specularia* and *Triodanis* may be regarded as segregate genera removed from *Campanula*. As the European species are still referred to *Campanula* in some recent works[1] and as the maintenance of *Triodanis*, distinct from both *Specularia* and *Campanula*, may be questioned by some workers, it is thought desirable to develop the argument for this position in some detail.

Many supposed genera have been removed from large and natural but not entirely homogeneous groups in a semi-mechanical way. Segregate genera of this kind are usually smaller than the inclusive groups from which they are taken, since the species often have in common not more than a single, arbitrarily chosen, distinguishing character. Segregation of such genera is not necessarily unwise, but the criteria must be well chosen[2] lest one recognize as many genera as species! It may be sound practice formally to delimit groups of species founded upon single or few characters, but the wisdom of the maintenance of these as independent genera is another matter, for at present we have no test, except that of individual and collective botanical opinion, by which generic limits may be determined. Ideally it may be supposed that genera constitute natural (that is, biological) units; in practice they often become conveniences, proposed perhaps because of exaggerated importance attached to some striking character, and maintained because of tradition and inertia.

Linnaeus (1753, 1754), in what we now call CAMPANULINAE, recognized *Campanula* and two additional genera, *Phyteuma* and *Trachelium*. Although the present concept of *Campanula* differs from that held by Linnaeus, chiefly because of the removal of various discordant elements imperfectly known to him, and now placed in *Wahlenbergia* and other distantly related groups, it seems that his ideas of classification (mostly borrowed from earlier authors!) have hardly been improved upon. *Campanula*, *Phyteuma*, and *Trachelium* remain the strongest genera, with *Adenophora* almost equally strong and *Asyneuma* but little less so. The remaining genera, without exception, are either monotypic, and accordingly unique or not according to the opinions of individual systematists (*Azorina*, *Campanulastrum*, *Campylocera*, *Cylindrocarpa*, *Favratia*, *Heterocodon*, *Ostrowskia*, *Petromarula*, *Rotantha*, *Sicyocodon* and some 20 others) or are small (up to about 6 species) and based upon characters of questionable importance (*Diosphaera*, *Michauxia*, *Specularia*, *Symphyandra*, *Tracheliopsis*, *Triodanis*).

[1] cf. Bentham, George, Handbook of the British Flora, ed. 7, 287. 1924.

[2] In Rafinesque's *Flora Telluriana* (1;81), in his "Fifty rules of generic nomenclature by Linneus and Rafinesque" is a sound bit of wisdom: "3. None but skilful Botanists ought to form and name Genera."

In an attempt to prepare a formal statement of generic criteria in the CAMPANULINAE, the following recommendations have been drawn up. It is thought that the separation of *Triodanis* from *Specularia* and *Campanula* is justified according to these recommendations. Although the latter have not been applied to any groups of species except among the CAMPANULINAE, it should be possible to make use of them in other families. Most of the suggested procedures are fairly obvious, but I am not aware of any previous attempt to evaluate and integrate them.

RECOMMENDATION 1. Primary consideration should be given by the systematist to strong morphological characters (that is, ordinarily, qualitative characters, or those involving changes in the nature of plant-parts, or the presence or absence of some distinctive attribute) rather than to the weaker characters (those involving changes in *number*, *shape*, *position* or *attachment* of parts).

Unfortunately for the systematist, when there is a question of generic distinctness there are usually no strong morphological characters involved; determination of obscure generic lines often must depend in approximately equal parts upon: 1), tradition resulting from the combined forces of inertia and botanical opinion; and 2), evaluation of weak morphological characters that appear to indicate some biological discontinuity.

Occasionally a "strong" character is not at the same time an obvious one; here recognition of actual generic limits may be delayed. In *Adenophora*, for example, all the species have a distinctive annular gland about the base of the style; this feature is not present in any other species-group of the *Campanula* complex, and the standing of the genus has not been challenged. The numerous species are mostly Asiatic, however, and the gland is inconspicuously located, so that the genus was not recognized as such until after 1820, although many of the species were known to earlier workers.

RECOMMENDATION 2. The erection, maintenance, or submergence of any segregate genus upon the basis of characters of minor import, or upon single characters, should be advocated only after full consideration of usage, which is the historical expression of botanical opinion.

The recognition of the power of tradition in determining generic lines may seem biologically unsound to some workers, but many genera that are not particularly distinct biologically are currently maintained because of tradition; this is often a satisfactory solution to a problem since there is no final or conclusive test for what is or is not a "good" genus. Except for the relatively rare cases involving conclusive morphological evidence, usage should be considered as of primary importance in determining the limits of "borderline" genera.

RECOMMENDATION 3. The most important criterion of any supposed genus is not the width of the gap between it and another, but its own biological unity. Homogeneity in many characters, regardless of the degree of overlapping of these characters with those of other genera, is the best

indicator of this unity. When homogeneity has been achieved, a segregate genus should be expected to form a group, any species of which will differ from those of other genera by some combination of perhaps insignificant characters, all or most of which may appear individually or in other combinations in the other genera.

Genera of the nature of satellites, if also comprising two or more series of species, invite suspicion especially if united by a single character which is also the only character separating them from a more inclusive genus. Even weaker is the segregate genus which exhibits among its species variations parallel to those found in the related but more inclusive genus.

RECOMMENDATION 4. Those proposing or advocating changes in status involving segregate genera should be guided by the diagnostic features of the more inclusive genera as they occur throughout the complete range of the group, and not by more or less narrow, regional similarities or dissimilarities. While those writing local floristic works must of necessity be slow in accepting proposed changes in nomenclature in order to avoid instability in popular usage, systematists should be wary of the taint of provincialism.

RECOMMENDATION 5. The systematist must make an independent decision in regard to the status of each proposed genus, basing his decision upon the relationships between the proposed segregate and some more inclusive genus, but not upon the supposed equality between it and some other segregate.

It is impracticable to attach relative degrees of importance to characters used in determining generic limits, or to combinations of these characters, so that it is clearly impossible to say that any two or more genera are equally well founded. Generic segregation, when advocated for the sake of supposed consistency within some major plant-group, leads to arbitrary rather than natural delimitation of genera.

RECOMMENDATION 6. Any segregate genus should be sharply delimited; that is, any species which is intermediate in one or more respects toward a more inclusive genus should be relegated to the latter. The retention of the anomalous species in the more inclusive genus will change its limits, if at all, but very slightly, and only in this way can the segregate genus be precisely defined.

RECOMMENDATION 7. While many plant-genera are segregated on the strength of single characters, it is clear that the security of the position of any genus increases rapidly in proportion to the number of differentiating characters that can be adduced, particularly if more than one species be involved. The relative importance of any single character varies even among genera of the same family, and is ultimately determined in any case by individual judgment.

RECOMMENDATION 8. The generic position of any segregate group, especially if it comprises two or more species, will probably be strengthened

if the group have a distinctive geographical range together with more or less distinctive morphological features. Workers may find that species which show anomalies in their geographical distribution also possess unsuspected structural peculiarities.

GENERIC STATUS OF SPECULARIA

When the criteria embodied in the above recommendations are applied to the species currently referred to *Specularia*, it appears that the genus in its traditional circumscription cannot logically be maintained apart from *Campanula*. It is not sharply delimited or homogeneous; the traditional features of the type species (a "rotate" corolla and a much elongated capsule) disappear entirely or partly in all the other species, and in addition the genus comprises two well-marked series of species, one having cleistogamous flowers and a spicate inflorescence and the other having normally open flowers and an expanded inflorescence. The corolla- and capsule-characters separating *Specularia* from *Campanula* are relatively weak ones, hardly sufficient in themselves to justify a generic segregation, even if they were of universal occurrence in the species of the segregate and wanting entirely in the other genus. As some undoubted species of *Campanula* (including annual species like *C. ramosissima* Sibth. & Sm., among the Campanulas which are presumably most closely related to the inclusive *Specularia*) have a rotate corolla, and most of the American species of *Specularia* have a short capsule not essentially different from that of many Campanulas, it is evident that these characters do not establish the genus very firmly, and do not necessarily indicate any considerable degree of biological affinity among the species.

It appears, however, that the inclusive *Specularia* may be broken up into relatively homogeneous biological units by the following steps: 1), restriction of *Specularia* as a genus to include not more than the type species and perhaps also *S. hybrida;* 2), removal of all American species and also the European *S. falcata* to *Triodanis;* and 3), return of *S. pentagonia* to *Campanula*.

The two remaining species of *Specularia* as thus restricted are both natives of western and southern Europe, with deeply divided open corollas, long capsules constricted beneath the calyx, glabrous and gradually dilated filaments, and branched inflorescences. The desirability of recognizing *Specularia* as a genus is still open to question, but the combination of divided corolla, elongated capsule and glabrous filaments is unique among the annual species of the *Campanula* complex, and these similarities may indicate some generic affinity between the two entities involved, although these are superficially dissimilar in aspect, degree of branching, and size and shape of flowers. Feer (1890, p. 609) went so far as to suggest that not only these species but also *Campanula Erinus* L., and *C. fastigiata* A.DC., which also have glabrous filaments, should be removed from *Campanula* on this account.

Campanula pentagonia L., in spite of its elongate capsule and the almost

spike-like inflorescence of some plants (the latter superficially very like *Triodanis coloradoensis*), I should not refer to *Triodanis* or to *Specularia*. It has the lobed (not deeply parted) corolla and dilated ciliate filaments of most Campanulas, and does not produce cleistogamous flowers. Apparently it has affinities with *Triodanis falcata* (Ten.) McVaugh and perhaps with *T. coloradoensis* (Buckl.) McVaugh but to refer it to *Triodanis* would be to break down completely the already meager distinctions between that genus and *Campanula*.

The remaining species of "*Specularia*" form a group which seems to constitute a genus on the basis of the recommendations given above, except that it has not been traditionally accepted. This is *Triodanis* Raf. Its homogeneity is unquestioned; the morphological features which distinguish it appear to be relatively strong ones in the Campanulaceae. The combination of annual habit, deeply divided corolla, capsule longer than wide and opening near the apex, spicate inflorescence, and regular production of cleistogamous flowers at the lower nodes is a unique one, and when found in a relatively large number of species surely points to a genetic discontinuity that may be called a generic distinction. The geographical distribution of the genus is not an unnatural one, the affinity between the flora of western arid North America and that of the Mediterranean region having been pointed out with respect to other genera (cf. *Centaurium*, *Trifolium*, etc.).

The cleistogamous condition in *Triodanis* is not peculiar to this group, but seems to be of importance there because of its universal occurrence in all the species, because of its correlation with the spikelike inflorescence and other characters, and because of the dominance it seems to exhibit in many species over the condition normal for most genera, chasmogamy or the production of open flowers.

Cleistogamy, with its accompanying reduction in size and number of parts of the flower, was early noted in the American species of *Triodanis*, particularly in *T. perfoliata*, in which it was seen by Linnaeus and his students (1748, 1756, 1792). Many subsequent European authors have contrasted this species of "*Specularia*" with the European species in which cleistogamy does not occur, but few have considered the character as of more than passing taxonomic interest.

Apparently *Specularia Speculum-Veneris* does not produce cleistogamous flowers, unless in exceptional cases. I have found but one reference to such a condition in this species, and that a questionable one. Hegi [Ill. Fl. Mit.-Eur. 6(1):367] says: "Bei dieser und verwandten Arten (besonders bei *S. perfoliata* DC.) sind von Kirchner und Helene Ritzerow kleistogame Blüten . . . nachgewiesen worden," but the reference to "dieser" [i.e. to *S. Speculum-Veneris*] seems to be in error. I can find no such reference in the works of Kirchner, and Ritzerow (1907) discussed the morphology of *Specularia perfoliata* but not that of any other species.

Darwin (1895) discussed the results of crossing and those of selfing in *Specularia Speculum-Veneris*. He made no mention of cleistogamy in this

species, but mentioned that of *S. perfoliata*, as if by contrast, in a footnote. Von Mohl (1863) wrote on the morphology of *S. perfoliata* without any mention of cleistogamy in any European species. Von Mohl's work was adapted without any significant additions by Knuth (1898). Ascherson, in two papers on cleistogamy (?1880, ?1889), alluded to the phenomenon in various genera and species, including the Egyptian *Campanula dimorphantha*, but not in the European Specularias with which he was presumably familiar.

Imperfect or abortive flowers in *Specularia hybrida* have been reported by various writers, including Linnaeus (1756), DeCandolle (1830) and Bromfield (1849), but Asa Gray (1876) denied the existence of such a condition in this species. Like Gray, "I have not found any trace" in *Specularia hybrida* of the extremely reduced flowers, with vestigial corollas, stamens, and style, which are universally present in *Triodanis*. Some of the flowers of *S. hybrida*, however, although apparently open and functional, are considerably reduced in size and apparently represent a step in the direction of truly cleistogamous flowers. I have not been able to determine the sequence, if any, in which these flowers are produced, but they seem not to be formed as a part of the regular flowering succession as in *Triodanis*, and presumably the two conditions have arisen independently.

Cleistogamy in the genus *Campanula* is rare but has been reported not only in *C. dimorphantha* (mentioned above) but also in 2 Indian species, *C. canescens* and *C. colorata;* the condition in these latter was noticed by DeCandolle and was elaborated upon by Hooker and Thomson (1858) and by Oliver (1862). The morphological changes induced by cleistogamy in the individual flowers of these Indian species are closely parallel to those in the American species of *Triodanis*, but the differences in general morphology between the two groups seem to preclude the possibility that these are closely related otherwise.

Another genus in which cleistogamy is of regular occurrence is the monotypic *Heterocodon*, of western United States and British Columbia. It appears that I was overly hasty in transferring *H. rariflorum* Nutt. to *Specularia* (McVaugh, 1941), for in spite of a superficial resemblance to the American species of *Triodanis*, it seems to have little in common with these. The general morphology of *Heterocodon* suggests that it has been derived rather from some ancestor more like the conventionally accepted species of *Campanula;* tradition, indeed, is apparently the strongest reason for keeping it out of *Campanula* at the present time. The flowers are usually said to be axillary but are actually terminal, and displaced laterally by the axillary branches which successively constitute the "main axis" of the plant. The corolla is tubular as in most Campanulas, and the very short and broad capsule is apparently closely similar to those of Campanulas with basally dehiscent capsules, rather than to those of *Triodanis*, which fundamentally are apically dehiscent. The placentae are very short and stalked, like those of many Campanulas with similar capsules, not elongate and sessile like those of *Triodanis*.

The capsule of *Heterocodon* was originally described by Nuttall (1843) as "dehiscing irregularly at the base"; Gray (1878) said "Capsule bursting indefinitely on the sides by the giving way of the thin walls," as opposed to the condition in *Campanula* and *Specularia*, in which the capsule was said to be "dehiscent by one or more small valvular openings on the sides, usually over a partition." Authors of floristic works including *Heterocodon* have without exception described the capsule as dehiscing irregularly; actually the mechanism is identical in principle with that prevailing in *Campanula* and related genera; an elastic portion curls outward and breaks out of the capsule, leaving an opening into two adjacent locules. In *Heterocodon* the margins of the opening are less clearly defined than in *Triodanis*, but the opening is similar to the type found in several species of *Campanula* with basally dehiscent capsules.

The pertinent characters of the genera discussed above are set forth in the following synopsis. It will be noted that the generic characters of the groups segregated from *Campanula* are all weak ones, in no case involving strong morphological features which absolutely separate them from the more inclusive genus, but always depending upon combinations of weaker characters which reappear individually in unrelated species of *Campanula*. Some workers may consider it a sound biological policy to submerge all of the segregates in *Campanula*. Of the three in question, *Triodanis* appears to be the strongest, comprising as it does 8 closely similar species. There is thus some morphological justification for it, but far less for *Specularia* and *Heterocodon*.

1. *Campanula* L. Plants perennial, biennial or annual, if annual usually dichotomously branched, rarely with spiciform inflorescence (cf. *C. americana* L., *C. pentagonia* L.) and never with both spiciform inflorescence and the lower flowers mostly cleistogamous; flowers normally all open, with expanded campanulate corolla, but occasionally partly cleistogamous (*C. canescens*, *C. colorata*, *C. dimorphantha*), if cleistogamous then pedunculate; open corollas usually not divided as far as the middle, if deeply parted in annual species then the ovary never greatly elongate and linear (cf. *C. ramosissima*); filaments usually abruptly dilated and ciliate at base, if gradually dilated and glabrous then the capsule short and broad and the corolla not deeply parted (cf. *C. erinus*, *C. fastigiata*); capsule various, opening at base, near middle or near apex (at base in annual species with cleistogamous flowers and short capsules, near apex in *C. pentagonia*, which has a greatly elongated capsule). A large and heterogeneous genus, widely distributed in the Northern Hemisphere.

2. *Heterocodon* Nutt. Plants annual, with short-pedunculate falsely lateral flowers, the earlier ones cleistogamous; open corollas not divided as far as the middle; filaments ciliate at base; capsules short and broad, opening near base. One species, western North America.

3. *Specularia* Heist. ex. Fabr. Plants annual, branching above the middle, the flowers nearly sessile, clustered near the tips of the branches or

corymbosely aggregated at the summit of the plant; flowers all open, or some imperfectly developed but open and not vestigial; corollas divided well below the middle, more or less rotate; filaments gradually widened to base, glabrous; capsule much elongate, linear, contracted at apex beneath the calyx-lobes, dehiscent at apex. Two species, western and southern Europe.

4. *Triodanis* Raf. Plants annual, the branches, if any, from base or middle of the plant; flowers axillary, sessile or essentially so, the inflorescence spiciform; flowers from the lower nodes normally cleistogamous, with the corolla and androecium vestigial; some of the upper flowers or at least the terminal one usually open (all corollas sometimes open in *T. coloradoensis*), with expanded corollas divided below the middle; filaments abruptly dilated and ciliate at base; capsule ovoid or clavate to linear or subulate, usually not abruptly contracted at apex, opening at the apex or (in *T. perfoliata*) at the middle or a little above it. Eight species, one chiefly Mediterranean, the others American.

SYSTEMATIC TREATMENT

TRIODANIS Raf., N. Fl. N. Am. 4: 67. 1837.

Specularia, sect. *Dysmicodon* Endl., Gen. 518. 1838.
Dysmicodon Nutt., Trans. Am. Phil. Soc. n. s. 8: 255. 1843.
Triodallus Raf. ex Nutt., Trans. Am. Phil. Soc. n. s. 8: 255, in syn. 1843.
Campylocera Nutt., Trans. Am. Phil. Soc. n. s. 8: 257. 1843.
Specularia sect. *Triodallus* Raf. ex Torr., Fl. N. Y. 1: 428. 1843.
Specularia sect. *Campylocera* (Nutt.) A. Gray, Proc. Am. Acad. 11: 82. 1876.
Specularia American authors, not Heist.

Plants annual, erect or reclining, simple or with ascending subordinate lateral branches (these except in *T. coloradoensis* chiefly from the nodes near the base of the plant, sometimes 10–12 in vigorous plants and almost equaling the main axis, the plant then with a rosette-like cluster of erect wand-like stems). Stems green, or at base yellowish to reddish- or purplish-brown, with about 5 subalate angles, these continuous with the decurrent leaf-bases; stems, at least the basal portion, vestite on the angles but only sparingly or not at all so between them. Plant consisting of a single straight axis having up to about 100 nodes, of which the lowest 10–15 or 25 produce foliage (sterile) leaves and the remainder produce sessile bracts and axillary sessile flowers (or in *T. coloradoensis* some axillary flowering branches). Leaves and bracts glabrous above (except in *T. coloradoensis* and *T. falcata*) or the lower leaves with a few hairs near the tip; lower surface of the leaves usually vestite like the base of the stem (pilose to hispidulous or scabrous), at least on the principal veins near the base of the blade; bracts often smooth and glabrous on both surfaces. Inflorescence spiciform, often dense and the bracts more or less imbricate, the flowers of the main axis and subordinate axes, if any, developing in succession from base toward apex except for the flower terminating the axis, which develops be-

fore those immediately below it; flowers in each axil 1–3 (rarely as many as 7–8), the axillary flowers of the spike terminating repressed lateral branches which under sufficient stimulus elongate slightly and produce 1 or 2 lateral flowers from this secondary axis or even 1–4 additional later flowers from these tertiary axes, all the flowers essentially sessile (in *T. coloradoensis* some of the branches regularly elongate and produce each 1–3 flowers near the tip); flowers at the lower fertile nodes regularly cleistogamous; flowers at some of the upper nodes, at least the primary ones terminating the axes, producing an open (chasmogamous) corolla; axillary axes, at least when 2- or more-flowered, bracteolate, the bracteoles minute or foliaceous, at the base of the primary flower, usually narrow, up to 3–4 mm. long or sometimes larger. Calyx-lobes green, sometimes much expanded and foliaceous, entire except usually for one callose-glandular tooth on each edge near base, the tooth occasionally enlarged and the calyx-lobe then serrate; lobes normally 5 and all alike in the open flowers, usually either 3 or 5, less often 4 in the cleistogamous flowers (except in *T. falcata* and *T. coloradoensis*), those of the cleistogamous flowers smaller, often relatively broader, 1 or 2 often smaller than the others. Corolla of the open flowers usually lavender-blue, glabrous or with a few bristles without near the tips of the lobes, with short narrowly funnel-form tube which is mostly less than one-third as long as the whole corolla, and 5 elliptic and abruptly acuminately pointed lobes which are mostly about twice as long as wide. Stamens normally 5, the filaments flattened, divided about equally into a narrow linear glabrous distal portion and a gradually dilated or abruptly rounded broad ciliate base; anthers linear, glabrous, longer than the filaments. Style pubescent distally half its length or more, and divided at tip into short branches equal in number to the locules of the ovary (that is, usually 3 except in *T. leptocarpa*). Cleistogamous flowers smaller than the open ones, the calyx and capsule somewhat smaller, the corolla, stamens and style reduced to minute rudiments. Capsules usually erect or ascending, linear, oblong or ellipsoid to clavate (subulate in the cleistogamous flowers of *T. leptocarpa*), at maturity tipped by the calyx-lobes, those of the cleistogamous flowers usually more nearly terete (rather than angled or sulcate), tending to be ellipsoid rather than oblong or clavate as in the open flowers, and bi- or trilocular (unilocular in *T. leptocarpa*); pores of the capsule equal in number to the locules (except sometimes in *T. leptocarpa*), usually distal, opening from base toward apex (except in *T. coloradoensis*), the opening brought about by the curling outward of an indurated cartilaginous process which is apparently derived from a portion of the ovary (or hypanthium) wall and a portion of the septum; this process breaks cleanly outward at one end, carrying with it rather regularly defined and cleanly dehiscent portions of the thin ovary wall of adjoining locules; the process (except sometimes in *T. leptocarpa*) remains attached at one end, its actual length obscured on external examination by a network of fine ribs. Seeds indefinitely numerous, mostly less than 1 mm. long, mostly chestnut- or dark brown, plump- or flattened-

lenticular, usually longer than wide, without prominent surface markings. Placentae axile (except in the unilocular ovary in *T. leptocarpa*), extending essentially the whole length of the capsule and attached to the axis along most of its length.

Type species: *Triodanis rupestris* Raf. [= *T. perfoliata* (L.) Nieuwl.].

In the interpretation of the keys and descriptions which follow, it should be remembered that measurements, and to some extent descriptive terms, are taken from representative individuals of the several species. All the species of *Triodanis*, and especially *T. perfoliata*, are exceedingly variable and fruitful, and the plants vary so greatly in size and appearance that it is impracticable to make a single description cover all individuals, and very depauperate plants have been omitted from consideration in making up the keys and descriptions. As in many other genera in the CAMPANULACEAE, flowers produced near the end of the growing season or at other periods unfavorable to the plant may be much reduced in size; such flowers are often half or less than half as large as those normal for the species. Furthermore, as in other (especially annual) species of the same family, plants growing under adverse conditions of habitat may flower and fruit when extremely small. These very dwarf plants may be quite different in aspect from plants developed under conditions more suitable for growth, and their parts may be abnormally reduced in size, so that one can hardly give the lower limits of variation.

It should likewise be remembered that the relative numbers of cleistogamous and open flowers are probably determined in part by environment, although the basic ratios in the different species are evidently determined by hereditary factors. In a series of papers dealing with the life-history of *T. perfoliata*, Trent (1940a, 1940b, 1942) has shown that in this species greater numbers of flowers of both kinds are produced upon exposure to light of greater intensity or of longer daily duration, cleistogamous flowers only being produced in the weaker light or that of short duration. He suggests that the relation is a nutritional one, the number of flowers produced being roughly proportional to the photosynthetic activity in the plant. This agrees with the general observation that plants growing under adverse conditions of habitat, excluding conditions of light, are smaller and with fewer, mostly cleistogamous, flowers.

Trent (1940a) has also described the development of the inflorescence in *T. perfoliata*. He points out that not all the flowers at any one node develop at the same time, but that there are several (1–4) successions of developing flowers, the number of successions depending upon the vigor of the plant and so indirectly upon the habitat, the growing season and other factors of the environment. The earliest flowers to develop are cleistogamous; these appear singly at the lowest fertile nodes and under unfavorable conditions they then appear successively at all the nodes. Under favorable conditions open flowers are produced at the upper nodes during this first succession. A plant collected early in this first cycle would

thus have a single cleistogamous flower in each of the lower axils and opening corolliferous (chasmogamous) flowers in the upper axils. At about the time of the appearance of the first open flowers, however, a second succession of cleistogamous flowers begins to appear at the lower nodes. These most commonly appear to be in pairs; that is, at the base of the first flower they appear to be opposite. Presumably each terminates a branch of the primary lateral axis represented by the earliest flower. The second and further successions of flowering may continue to the upper nodes of the plant under favorable conditions; in the upper nodes most of the flowers are cleistogamous after the first succession.

KEY TO THE SPECIES OF TRIODANIS

1. Foliage leaves (not flower-bracts!) usually strigose or hispidulous on the upper surface; calyx-lobes mostly 8–15 mm. long, 5 in number and all those in any flower essentially alike, both in open and cleistogamous flowers; capsule trilocular (as shown by the number of pores) in both types of flowers, oblong-linear to clavate, usually 10 mm. long or more . . 2.

    2. Capsule opening from apex toward base; corollas mostly 9–15 mm. long; south-central Texas . . . . . 1. *T. coloradoensis.*

    2. Capsule opening from base toward apex; corollas mostly 6–10 mm. long; Mediterranean region and east to Iran . . . . . 2. *T. falcata.*

1. Leaves glabrous on the upper surface (sometimes with a few bristles near the tips); calyx-lobes usually less than 10 mm. long (usually much less than this, at least in the cleistogamous flowers), often 3 in number in the cleistogamous flowers or with 1 or 2 notably smaller than the others; capsule usually bilocular (sometimes unilocular) in the cleistogamous flowers, trilocular in the open ones, variously shaped . . . . . 3.

    3. Flower-bracts lanceolate to linear, usually 6–8 times as long as wide; capsules of the cleistogamous flowers terete, subulate, curved and with more or less spreading tips, 8–12(–20) mm. long, dehiscent by longitudinal apical fractures or a single apical pore; seeds 0.7–1 mm. long; prairies of the central United States . . . . . 8. *T. leptocarpa.*

    3. Flower-bracts ovate or broader, sometimes as much as 2–3 times as long as wide, but often as wide as or wider than long; capsules of the cleistogamous flowers terete or flattened, oblong to ellipsoid or ovoid, straight and more or less appressed, usually less than 8 mm. long (occasionally to 12 mm. long), dehiscent by 2 (or 3) apical or lateral pores; seeds various . . . . 4.

    4. Openings of the capsule linear, 0.2–0.4 mm. wide, the elastic cartilage before dehiscence occupying most of the pore (i.e. with very narrow scarious margins); pores about midway between base and apex of capsule; seeds 0.4–0.7 mm. long, minutely low-tuberculate in longitudinal lines; prairies, central United States . . . . . 7. *T. Holzingeri.*

    4. Openings of the capsule broadly elliptic, oval, or rounded, 0.5–1.5 mm. wide, the narrow cartilage with broad

rounded scarious margins; pores about midway between base and apex, or near apex of capsule; seeds various. . 5.

5. Seeds more or less quadrangular, 0.4–0.6 mm. long, the surface roughened with low anastomosing longitudinal ridges; pores about the middle of the capsule; eastern Texas.....6. *T. texana.*

5. Seeds lenticular, often plump (occasionally umbonate), the surface smooth and more or less polished, or muriculate, but never ridged; pores near the apex or near the middle.....6.

6. Seeds 0.8–1 mm. long, smooth and highly polished, biconvex but rather flat; pores at the apex of the capsule; bracts ovate to reniform, rather coarsely toothed, often broader than long, 10–25 mm. broad; Missouri, Arkansas, and Oklahoma.....5. *T. lamprosperma.*

6. Seeds 0.5–0.6 mm. long, polished or dull, or muriculate, plumply lenticular; bracts and pores various.....7.

7. Pores at or very near the apex of the capsule; seeds smooth and highly polished; bracts usually longer than broad, not prominently veined beneath, only the midrib or 1 additional pair of veins evident; open corolla usually 1 (the terminal) only, or scattered axillary flowers with open corollas.....3. *T. biflora.*

7. Pores well below the apex of the capsule (usually 1–1.5 mm.), usually about midway between base and apex; seeds muriculate or smooth and lustrous; bracts usually as broad as or broader than long, often with one or two pairs of veins in addition to the midrib prominent beneath; several of the upper nodes normally producing open corollas.....4. *T. perfoliata.*

1. **Triodanis coloradoensis** (Buckl.) McVaugh, comb. nov.

Campanula coloradoense Buckl., Proc. Acad. Phila. 13[1861]: 460. 1862.
Specularia Lindheimeri Vatke, Linnaea 38: 713. 1874.
Pentagonia coloradensis Kuntze, Rev. Gen. 381. 1891.
Legouzia coloradoense Heller, Contr. Herb. Frankl. & Marsh. Coll. 1: 99. 6F 1895.
Specularia coloradoensis Buckl. ex Small, Fl. Southeast. U. S. 1142. 1903.
Legousia coloradoensis Briq., Candollea 4: 332. 1931.

Erect, the stems 25–60 or often 100 cm. high and up to 3 mm. in diameter, prominently angled, simple or usually with ascending subordinate branches 5–15 (rarely 30) cm. long from the nodes just above the middle of the plant (usually not with basal branches), the stem-angles near base

retrorsely scabrous or hispid (occasionally smooth or with long hairs immediately below the leaf-bases), the upper parts usually smooth and glabrous. Leaves and bracts more or less hispid or scabrous at least on the veins beneath, their margins ciliate with numerous short, broad-based hairs, these often much longer near the base of the blade; leaves up to the first branch usually hispid above, the succeeding bracts less so, often smooth above; upper and middle foliage leaves oblanceolate or elliptic, sessile, attenuate to base and to a blunt or acute and mucronate apex, inconspicuously crenate especially on the distal half with 6–10 callose teeth on each side, the teeth often hardly visible among the stout marginal hairs, the blades mostly 5–8 times as long as wide, 0.4–1(–1.5) cm. wide, 2.5–5(–7) cm. long; lower and basal leaves relatively broader and more conspicuously toothed, the lowest often elliptic, rather abruptly narrowed to a blunt tip and a margined or slender petiole up to 2.5 cm. long; bracts, including those subtending flowering branches, lanceolate, sessile, narrowed and somewhat rounded at base, narrowly acute, attenuate to the callose-glandular tip, the median ones (those of the lowest sessile or nearly sessile flowers) often 10–12 times as long as wide, 2–5 mm. wide, 2–4 cm. long, minutely callose-denticulate. Flowers in a loosely spiciform arrangement on the main axis above the flowering branches, the flowers sessile or nearly so, 1–3 at each of the uppermost 4–6(–9) nodes on the axis and in groups of 1–3 near the tips of the flowering branches, all (including the terminal ones) prevailingly fertile and open, but those of the lower branches and/or the lowest ones of the main spike sometimes cleistogamous; bracteoles evident even in the uppermost flowers; corolla of the cleistogamous flowers obovoid or cylindroid, 1–2 mm. long; opening corollas "blue purple" (Bebb), 9–15(–18) mm. long, the tube 2–4(–5) mm. long, the lobes 3.5–6(–8) mm. wide. Filaments mostly 2–2.5 mm. long, the distal third slender and glabrous, the proximal two-thirds dilated, oblong, ciliate. Anthers (2.7–)3–4.3(–5) mm. long. Capsule scabrous-papillose at least near base, oblong-linear or clavate, usually abruptly narrowed distally to the base of the calyx, 2–2.5(–3) mm. in diameter and 11–18 mm. long (in the cleistogamous flowers) or up to 23 mm. long (in the open flowers), deeply sulcate between the locules; pores opening toward the base, broadly elliptic or rounded, 1.5–2.5 mm. below the base of the calyx, 0.8–1.7 mm. wide, 2–4 mm. long (the proximal end often ill-defined), the narrow central cartilage with broad rounded scarious margins, curled outward and downward into a half circle, locules and pores 3 in both types of flowers; style 6–10 mm. long, the branches mostly 1–1.5 mm. long. Calyx-lobes 5 in both types of flowers, lanceolate, loosely spreading in fruit, with slender subulate tips, usually with 1 or 2 capillary bristles at tips, the margins scabrous-ciliate, in the open flowers all alike (0.7–)1–1.5(–1.8) mm. wide, (6–)10–17 mm. long, in the cleistogamous flowers a little shorter and often unequal in width. Seeds brown, smooth and lustrous, biconvex and more or less flattened, usually about 0.7 mm. wide and 0.8–1 mm. long.—Dry rocky hillsides and bluffs, limestone ledges, rich woods, flood plains and gravel bars, flowering from

late April to early June, Edwards Plateau and adjacent territory, south-central Texas.

Representative specimens examined[3]: TEXAS: Bell Co., Salado, *S. E. Wolff 2966* (TA&M, US); Bexar Co., Leon Springs, *Mr. & Mrs. J. Clemens 878* (Mo,R), San Antonio, *V. Havard* in 1884 (US), *E. H. Wilkinson 87, 152* (Mo), *R. Bebb 2343* (Okla); Blanco Co., Blanco, *E. J. Palmer 33955* (Mo); Comal Co., bei Braunfels, *F. Lindheimer 65* [III 450, isotype of *S. Lindheimeri*] (Mo); Crockett Co., Ozona, *V. L. Cory* in 1925 (TA&M); Gillespie Co., Crab Apple Cr., *G. Jermy 468* (Mo); Kendall Co., Lindendale, *Palmer 9885* (Mo, US); Kerr Co., Kerrville, *A. A. Heller 1731* (ANS, IA, Mo, R, US); Kimble Co., *J. Reverchon 582* (ANS, Mo, TA&M, US); Menard Co., Menard, *Palmer 11855* (Mo); Real Co., Thousand Springs, *H. B. Parks & V. L. Cory 8568* (TA&M); Travis Co., Austin, *E. Hall 384* (Mo, US), *A. A. Armer* [UTex 5529] (Tex, US), *Palmer 13652* (Mo, US); Uvalde Co., Uvalde, *Palmer 33712* (ANS, Mo); Valverde Co., Devils River n. of Del Rio, *H. A. Pilsbry* in 1903 (ANS); Wichita Co., Red River, *B. C. Tharp* in 1922 (IA); Williamson Co., Georgetown, *G. B. Wolcott 300* (USNA); County undetermined, "On the upper Colorado, Texas," *S. B. Buckley* in 1861 (ANS, type!); without locality, *Lindheimer III 450* (ANS, Mo, US, all doubtless isotypes of *S. Lindheimeri*); Blanco, *C. Wright s.n.* (Mo); without locality, *Wright 1432* (ANS); Valley of the Rio Grande below Doñana, *C. C. Parry et al.* [Mex. Bound. Surv. 698, in part] (US); Clearwater, Oregon, *Spalding s.n.* (ANS).

One of the above records needs confirmation, namely the collection from Wichita County, Texas, which is well out of the known range of the species. The specimen alleged to have been collected by Spalding at Clearwater, Oregon [i.e. Idaho], is evidently erroneously labelled.

The type of *Campanula coloradoense*, collected by S. B. Buckley in June, 1861, on the "upper Colorado, Texas," now at the Academy of Natural Sciences, is a mature flowering specimen with numerous open flowers. The type of *Specularia Lindheimeri* was at Berlin; the only specimen cited by Vatke was Lindheimer's no. 450, of Fascicle III, collection of 1846. I have not seen the type, which may now have been destroyed, but specimens bearing this number and date are widely distributed in herbaria and all represent the same species. Lindheimer's number 450 seems

[3] In the preparation of this paper I have examined material from the following herbaria, indicated below in the citation of specimens by appropriate abbreviations. To those who have made this material available for study, I am very grateful: Academy of Natural Sciences, Philadelphia (ANS); Colorado State College, Fort Collins; Herbarium of C. C. Deam, Bluffton, Indiana; Gray Herbarium, Harvard University (GH); Universitetets Botaniske Museum, Copenhagen (Haun); Herbarium of L. C. Hinckley, Marfa, Tex.; Iowa State College, Ames (IA); Kansas State College, Manhattan (Kans); Louisiana State University, Baton Rouge (LSU); Missouri Botanical Garden, St. Louis (Mo) University of Oklahoma, Norman (Okla); Rocky Mountain Herbarium, University of Wyoming (R); Herbarium of Robert Runyon, Brownsville, Tex. (Runyon); Southern Methodist University, Dallas, Tex. (SMU); Sul Ross State Teachers College, Alpine, Tex.; University of Texas, Austin (Tex); Texas A. & M. College, College Station (TA&M); North Texas State Teachers College, Denton (NTSTC); U. S. National Herbarium (US); U. S. National Arboretum (USNA).

to have been applied to more than one collection, however, for at the Missouri Botanical Garden are specimens each bearing the number 450 but collected, respectively, in April 1845, and May 1846. Presumably the latter is the collection of which Vatke had a sheet, for the specimen is accompanied by Lindheimer's original handwritten label in addition to the printed label bearing the number 450 and the "Fasc. III"; the handwritten label bears the number 65, evidently a field-number, and the date "Mai 1846," with the locality "bei Braunfels" and the notation "30 Exemplare," the latter suggesting wide distribution for the plants collected at this time.

It should be pointed out here that if this species be referred to *Specularia* the valid name for it is *Specularia Lindheimeri* Vatke, for the transfer of *Campanula coloradoense* Buckl. to *Specularia* is prevented by the existence of the name *Specularia coloradoensis* Buckl. ex Small, which was published legally but probably inadvertently, without reference to *Campanula coloradoense* or to any previous publication by Buckley.

The many features that this species shares with *Triodanis falcata* are certainly indicative of some relatively close relationship or of a remarkable parallel development. Were it not for the capsule of *T. coloradoensis* opening from apex toward base, I should suggest the establishment of a formal section of *Triodanis*, to include these two species. This anomaly, however, suggests that the two species should not be too closely linked on the basis of what may be fortuitous resemblances.

Triodanis coloradoensis and *Campanula Reverchoni* A. Gray are unique in their respective genera in the direction in which their capsules open; that is, from apex toward base. Except for this feature common to both, neither species shows any marked anomalies. The geographical propinquity of the two (both are confined to south-central Texas) inevitably suggests some phylogenetic connection between them, but they are dissimilar in morphology except for this one character, and the apparent relationship between them is hardly closer than that between *T. falcata*, for example, and *Campanula ramosissima*. One may argue that this peculiarity of the capsule of these species suggests for them an origin different from that of the remainder of the species of *Triodanis* and *Campanula*, or suggests a di- or polyphyletic origin for these genera. On the other hand it emphasizes the fact that the relationship between genera, specifically between *Triodanis* and *Campanula*, is probably not to be thought of as a simple linear one, but as a series of links between groups of species. It is unwise to attempt to reason too far from this single capsule-character, however, for it seems likely that it is not a particularly fundamental feature; the direction of opening of the capsule depends upon the relative strengths of the tissues at the two ends of the elastic portion of the capsule, and these may well undergo a change in the majority of any population in comparatively few generations.

2. **Triodanis falcata** (Ten.) McVaugh, comb. nov.

Prismatocarpus falcatus Ten., Prodr. Fl. Nap. 16. 1811.
Campanula syriaca R. & S., Syst. 5: 133. 1819.

Campanula falcata R. & S., Syst. 5: 154. 1819.
Specularia falcata A. DC., Monog. Campan. 345. 1830.
Prismatocarpus scaber Lowe, Trans. Camb. Phil. Soc. 6: reimp. 16. 1838.
Specularia falcata var. *scabra* (Lowe) A. DC. in DC., Prodr. 7(2): 490. 1839.
Specularia castellana Lange, Ind. Sem. Hort. Haun. 1854: 25. 1855.
Specularia falcata var. *pusilla* Boiss., Fl. Or. 3: 960. 1875.
Pentagonia falcata Kuntze, Rev. Gen. 381. 1891.
Legousia falcata Fritsch, Mitteil. Naturw. Ver. Wien 5: 100. 1907.

Erect or reclining, the stems (5–)15–60 cm. high and 1–2.5 mm. in diameter at base, smooth and glabrous or minutely scabrous on the angles, or the whole plant scabrous or hispidulous. Foliage leaves nearly glabrous, strigose or hispidulous above and on the veins beneath, finely and densely ciliate with very short broad-based hairs except near base, the decurrent bases and the petiolar bases of the lowermost blades bearing on each margin a row of slender white cilia 1–2 mm. long; bracts mostly glabrous except for the ciliate or scabrous margins; blades of the foliage leaves sessile, elliptic to oblanceolate or obovate, rounded or blunt-pointed at tip, acute at base or the lower attenuate into a margined short petiole, all crenate with 2–6 shallow teeth per cm., 2–3(–4) times as long as wide, mostly 7–10(–20) mm. wide, (8–)15–30(–40) mm. long, the lower leaves usually smaller and rounder, with definite petioles up to 6–10 mm. long (sometimes all leaves petiolate, the lower petioles slender, up to 4 cm. long); bracts sessile, mostly ovate, with broad rounded base and acute tip (blunt and mucronate at extreme tip), the median ones mostly 2–2.5 times as long as wide, 4–10(–20) mm. wide, 18–27(–40) mm. long, inconspicuously crenate with 6–7 teeth on each side, often appearing subentire. Flowers in a loose spike occupying 6–15 nodes below the terminal flower, at least those of the lower nodes cleistogamous; branches at the lower nodes of the spike sometimes appreciably elongated and bearing 2 or 3 fertile flowers, but usually only the terminal flower maturing; terminal flower of the main axis usually maturing fruit, often open. Corolla of the cleistogamous flowers cylindroid, 0.8–1.6 mm. long; opening corollas rose-colored (according to A. DC.), pale purple (Cowgill), or purple (Koelz) 6–10 mm. long, the tube 1–2.5 mm. long, the lobes about 2.5–3.5 mm. wide. Filaments about 1.2–1.5 mm. long. Anthers (1.7–)2–3.5 mm. long. Capsules in both sorts of flowers trilocular, prominently scabrous at least on the 3 angles of each locule, oblong-linear or clavate (in depauperate plants shorter and obovoid), 2.5–3 mm. in diameter, 8–16(–25) mm. long, often slightly curved, rather deeply sulcate and the pores sunken; pores at the distal extremity of the capsule, 0.7–1.2 mm. wide, 2–3 mm. long, the central cartilage narrow, with broad scarious margins, divaricate or completely recurved after opening. Style 5–6 mm. long, the branches 1 mm. long. Calyx-lobes 5, all alike or those of the cleistogamous flowers slightly shorter and 1 or 2 narrower than the others, all linear-subulate or often broader, smooth and glabrous or sometimes ciliate or scabrous on the margins, mostly 1–2 mm. wide at base and 9–16 mm. long (sometimes up to 8 mm. wide and 3 cm. long), often spreading or recurved-falcate, the margins often revolute. Seeds bright chestnut-

brown, smooth, highly polished, lenticular, about 0.8–1 mm. long and almost as wide.—Fields, orchards and cultivated grounds generally, dry rocky woods, shaded rocks, in areas bordering the Mediterranean Sea and on the Mediterranean islands; Canary Islands; east to Iran and the Caucasus; flowering and fruiting from April to July.

Flowers intermediate between the cleistogamous ones and the normal open ones have open but narrowly tubular corollas up to 6 mm. long, style up to 4.5 mm. long and anthers 1.2–1.5 mm. long.

The type of *Prismatocarpus falcatus* came presumably from Naples, Italy, or its vicinity; I have not been able to examine Tenore's original description of *P. falcatus*, or any authentic specimens.

Specimens examined: CANARY ISLANDS: without locality, *Desprieux* (ANS); Gran Canaria, Canaria, *A. C. Cook 355* (US); Lanzarote, Rib. de Sta. Luzia, *J. M. Moniz 795* (GH); Teneriffe, Laguna in arvis, *H. de la Perrandière* in 1855 (GH, Mo); Hieris-Las Lapas, *C. J. Pitard* in 1905 (Mo). BALEARIC ISLANDS: Majorque, Barranco de Soller, *E. Bourgeau* in 1869 (US). FRANCE: Var: LeLuc, *Metz* (?) in 1868 (US); Cannes, ex hb. Joad, in 1851 (Mo); Alpes Maritimes, Mt. Authion, *M. Moggridge* in 1868, in part (US). CORSICA: without loc., "Serafino misit Sept. 1832" (GH); stagno de Palo-Bachbett, *P. Aellen 2779* (Mo). SARDINIA: Sta. Teresa Gallura, par Tempio, *E. Reverchon* in 1881 (GH,US). ITALY: Liguria occid., Ventimiglia, *C. Bicknell* [Fiori & Béguinot 2366] (GH); "massif di Pegli Lig[uriae] occid.," coll. in 1856 (Mo); Corniglia (Spezia) presso le Tre Crosi, *O. Mattirolo Fontana* (?) in 1928 (USNA); Anxur [Terracina], *J. Ball* in 1841 (GH); Lesina Island, Dalmatia, *Roemer* (hb. G. Engelmann, Mo). CYPRUS: "in mont. pr. Palaeo Khova," *Sintenis & Rigo 23* in 1880 (US). PALESTINE: Banias, *Post 95* in 1877 (ANS). SYRIA: near Brumana, *A. Kneucker* in 1904 (GH). IRAN: "In umbra rupium m. Kuh-Ajub prope ruinas u. Persepolis," *Th. Kotschy 407* (isotype of var. *pusilla* Boiss., Mo); Talimansur, Bakhtiari, *W. Koelz 15085* (USNA). FROM CULTIVATION: "E. semin. H. Parisiensis (1893) in Ho. experim.[li] Vallisumbrosae culta," *R. F. Solla* in 1894 (US); from seeds collected in Iran (*W. Koelz 6036*), U. S. Plant Introduction Garden, Glenn Dale, Md., *W. Cowgill 2435* (USNA).

Specularia falcata var. *pusilla* Boiss. is the name applied to the ecologically dwarfed form of this species. The original specimens collected by Kotschy resemble those taken by Koelz (no. 15085) in the same general region; the plants are mostly 10 cm. high or less and open flowers are not developed. Plants grown at Glenn Dale, Maryland, from Iranian seed collected by Koelz, however, grew 30–50 cm. high, although the height of the original plants was noted by Koelz as "about 6 inches." If transferred to *Triodanis*, Boissier's name should be used to designate a *forma*, not a variety.

Boissier (1875) cites various specimens that I have not seen, including examples from Mt. Parnes, Attica (coll. *Heldreich*), the Island of Rhodes (*Bourgeau*), Cilicia (*Balansa*), the littoral of Syria and lower Lebanon (*Blanche, Gaillardot*) Mt. Carmel, Palestine (*Boissier*), and Mts. Avroman, Schahu, Pir Omar, Gudrun, all of Kurdistan (*Haussknecht*).

Additional locality records for Syria and Palestine may be found in Post's flora (1933, p. 170), and a single record for the Caucasus (Alagir, on the Ardon, *Lagofsky*) is given by Fomin (1906).

The status of *Specularia castellana* Lange is unknown to me; perhaps it should be recognized as a species, but I have not seen any material referable to it. According to Lange it differs from *S. falcata* by its shorter calyx-lobes and the scabrosity of the whole plant. Lange supposed also that his plant was the same as *S. falcata* var. *scabra* (Lowe) A. DC. Many European workers have recognized both *S. falcata* and *S. castellana*. The two species are separated by Coste (Fl. France 2: 491. 1937) as follows:

1. Calyx smooth, the lobes about as long as the tube at anthesis, the corolla about a third as long as the calyx-lobes; plant more or less glabrous. ..... *S. falcata*
1. Calyx scabrous, the lobes a third or a half as long as the tube, about equaling the corolla; whole plant more or less scabrous..... *S. castellana*.

3. TRIODANIS BIFLORA (R. & P.) Greene, Man. Bot. San Francis. Bay 230, without citation of name-bringing synonym. 1894; Nieuwl., Am. Midl. Nat. 3: 192. 1914.

Campanula biflora R. & P., Fl. Per. 2: 55. 1799.
Campanula montevidensis Spreng., Syst. 1: 738. 1825.
Specularia biflora Fisch. & Mey., Ind. Sem. Hort. Petrop. 1: 17. 1836.
Dysmicodon californicum Nutt., Trans. Am. Phil. Soc. n. s. 8: 256. 1843.
Dysmicodon ovatum Nutt., Trans. Am. Phil. Soc. n. s. 8: 256. 1843.
Campanula intermedia Engelm. ex Nutt., Trans. Am. Phil. Soc. n. s. 8: 256, in syn. 1843.
Specularia californica Vatke, Linnaea 38: 714. 1874.
Specularia ovata Vatke, Linnaea. 38: 713. 1874.
Campanula ludoviciana Torr. ex A. Gray, Proc. Am. Acad. 11: 83, in syn. 1876.
Pentagonia biflora Kuntze, Rev. Gen. 381. 1891.
Legouzia biflora Britton, Mem. Torrey Bot. Club 5: 309. 10 Oct. 1894.
Specularia perfoliata f. *ramosa* Arech., Anal. Mus. Nac. Montevideo 7[Fl. Uruguay 4]: 14. 1909.
Specularia perfoliata f. *rigida* Arech., Anal. Mus. Nac. Montevideo 7[Fl. Uruguay 4]: 14. 1909.

Slender, erect or reclining, the stems 15–45(–80) cm. long, 1–1.5(–3) mm. in diameter, densely to rather sparsely hirsute below with pale flaccid hairs, the hairs reduced above and the upper parts of the stem retrorsely hispid or merely scabrous. Leaves and bracts hispid (chiefly on the veins) to completely glabrous beneath; foliage leaves elliptic to ovate, the lowermost often obtuse and short-petiolate, the upper more acute and sessile, all the blades crenate, 6–12 mm. wide, 10–30 mm. long, usually 1.7–2.5(–3) times as long as wide; bracts relatively broader, ovate, sessile and somewhat clasping, sharply acute and often mucronate at tip, often spreading and usually not much concealing the fruits, the middle ones 2.5–12 mm. wide, 6–16(–20) mm. long, usually 1.3–1.8(–2.5) times as long as wide, the margins crenate on the proximal two-thirds of the blade with 1–3 teeth

on each side of the midrib, the basal teeth occasionally prolonged and the bracts then 3–(5–) lobed. Flowers at most or all the (10–50) nodes of each axis, the main axis terminated by an open flower; axillary flowers 1–4(–8) at each node, usually consisting of a terminal and 2 lateral ones, but one or two often aborting, one flower in this lateral sub-inflorescence occasionally producing an open corolla in vigorous plants, but only the terminal flower of each main branch regularly of this type. Corollas of the cleistogamous flowers rounded, scarcely 0.5 mm. high; opening corolla "blue," "purple," "lilac," "violet," "white with violet lines," "pinkish-blue" or "rose-red," glabrous or sparsely hirtellous on the veins without and ciliate at the tips of the lobes, 5–9(–11) mm. long, the tube 1–1.5(–2) mm. long, the lobes 2–3(–4.5) mm. wide. Filaments 1.3–2 mm. long, the proximal half gradually or abruptly expanded. Anthers (1.4–)1.6–2.2(–2.6) mm. long. Capsule glabrous or sparsely hispid, at maturity ellipsoid, clavate, obovoid or ovoid, mostly about 1.3–1.7 mm. in diameter (sometimes 2 mm., or when bilocular 1 by 2 mm.) and 4.5–7 mm. long (occasionally 2–9 mm.), the oval or nearly circular pores at the distal extremity or occasionally as much as 0.3–0.5 mm. below it, 0.5–0.8(–1.0) mm. wide, 0.7–1.8(–2.2) mm. long, with narrow central cartilage and broad scarious margins, tightly uprolled after opening; locules and pores usually 2 only in the cleistogamous flowers. Style 3.5–6.5 mm. long (2 mm. in depauperate plants), the branches 1 mm. long or less. Calyx-lobes triangular or triangular-ovate (then somewhat narrowed at base), acutely pointed and often mucronate, glabrous or sparsely hirtello-scabrous, closely appressed or somewhat spreading or recurved in fruit, those of the open flowers 0.7–1.5(–3) mm. wide, (3.5–) 4–6(–7) mm. long; those of the cleistogamous flowers 3–5, 0.3–1 mm. wide, 1–3(–4) mm. long, 1 or 2 often much smaller than the others. Seeds chestnut-brown, smooth and highly polished, biconvex, 0.5–0.65 mm. long, a little longer than wide.—Paraguay, Uruguay and southern Brazil (Rio Grande do Sul, Rio de Janeiro); Argentina and Chile south about to lat. 41° and north to Tucumán and Jujuy; cis-Andean Peru and Chile and highlands of trans-Andean Peru and of Ecuador; sandy embankments, grassy slopes, margins of forest, cultivated fields, sandy beds of dry rivers, coastal deserts, at elevations from sea-level to about 3000 meters, flowering from September to February (also collected May to August in the Peruvian highlands). Southeastern Virginia to Florida and westward in the Coastal Plain and Piedmont; west of the Appalachian Mountains from southern Kentucky to southeastern Kansas and southward to southern Texas, Nuevo León and San Luis Potosí; central and southeastern Arizona; northern Baja California to southwestern Oregon; in various situations, including waste and cultivated fields, prairies, dry hills, forests, moist river-banks and deep canyons, chiefly at low elevations, flowering and fruiting from April to June or earlier in southern Florida, southern Texas, Arizona and southern California.

The South American plants of this species appear to be not even varietally distinct from those of North America, although the former are often

(but by no means always) more densely pubescent. In the material I have examined the only measurable differences between the two series are those which appear to be the result of inadequate sampling of one population or the other. The corollas of most South American specimens, for example, measure between 6 and 7.5 mm. in length, while those of most North American plants measure between 7 and 9 mm., but with a fair sprinkling of corollas 5–6 mm. long, and some 9.5 to 11 mm. The anthers of South American plants rarely exceed 2 mm. in length, while many North American specimens have them 2.2 mm. long, and a few have them 2.5 to 2.6 mm. The calyx-lobes of the open flower rarely exceed 1.5 mm. in width, but in one South American specimen they measure 3 mm. Open flowers in addition to the terminal one are occasionally met with both in North American and South American specimens, but the percentage of plants bearing such flowers is higher among the South American, as far as my examination shows.

Most South American material of *T. biflora* in American herbaria has been identified as *Specularia perfoliata*, but apparently that species does not occur naturally in South America, except possibly in Ecuador. The type of *Campanula biflora* R. & P., as represented in Field Museum negative no. 29455, is an average plant of the rather hairy South American form of the species here called *Triodanis biflora*.

John Torrey seems to have been the first to understand clearly that in the southeastern United States there were two distinct species, both of which had before him usually been referred to *Campanula perfoliata* of Linnaeus. Torrey noted in his flora of New York (1843, vol. 1, p. 428–9) that he had described "the structure of the early flowers of this plant [*Specularia perfoliata*], and of an allied but very distinct species from Louisiana," in a memoir read before the New York Lyceum of Natural History, in 1830. Apparently this allied species, *Triodanis biflora*, was called by Torrey *Campanula ludoviciana*, for this name is found on herbarium labels attached to plants collected as late as 1875, but he seems never to have published it, although on this point Gray (1876) was in doubt.

Nuttall likewise recognized that *Campanula perfoliata* had been too broadly interpreted, and also supposed the Californian plants of what we now call *Triodanis biflora* to comprise a species distinct from those of the southern and central states. The type-material of *Dysmidocon californicum* is apparently not represented in the herbarium of the Philadelphia Academy, but from Nuttall's description it is evident that his plant must have been *T. biflora*. Under *Dysmicodon ovatum* Nuttall gave *Campanula intermedia* Engelmann as a synonym, with the locality "Fort Gibson, Arkansas," and the additional locality "Arkansas and Louisiana." In the Academy's collection is a Nuttall collection from "Ark.," labelled with Nuttall's asterisk indicating a new species, and the name "*ovata*" associated with an unpublished generic name; this may be considered the type collection of *Dysmicodon ovatum*. The plant is characteristic *Triodanis biflora*. Mounted on the same sheet is a plant of the same species designated by

Nuttall with the generic and specific names that appear on his Arkansas collection; in another hand is written on the ticket "Louis[iana] Trudeau." This is evidently the basis for Nuttall's reference to Louisiana. Also in the Academy's collection is a sheet of Engelmann's collection of *Campanula intermedia*, made in "Arkansas," June 1835. This collection includes at least 4 plants of *Triodanis biflora* and 1 which may be of hybrid origin; it bears Engelmann's original label, but no definite locality. Presumably, however it is the collection from Fort Gibson alluded to by Nuttall.

In the southeastern United States, where *T. biflora* and *T. perfoliata* are both common and are often found growing in intimate association, it may be supposed that the two species hybridize; certainly there are occasional plants which are not referable with certainty to either species and which must be regarded as intermediates. These will be discussed under *T. perfoliata*. I do not think there is justification for the view expressed by Holzinger (1892, p. 210) that the two species should be combined into one because of the many puzzling forms. In spite of these puzzling intermediates, *Triodanis biflora* is apparently biologically distinct from *T. perfoliata;* perhaps the best evidence for this may be found in its habit of producing but a single open flower, even under favorable conditions for growth. This is evidently determined by generic factors in this species, while in *T. perfoliata* and the 3 species segregated from it in this paper individual reductions in the number of open flowers are determined chiefly by environment, and in average healthy individuals open flowers are produced at several of the upper nodes.

4. TRIODANIS PERFOLIATA (L.) Nieuwl., Am. Midl. Nat. 3: 192. 1914.

Campanula perfoliata L., Sp. Pl. 769. 1753.
Campanula amplexicaulis Michx., Fl. Bor.-Am. 1: 108. 1803.
Campanula flagellaris H. B. K., Nov. Gen. & Sp. 3: 301. 1819.
Prismatocarpus perfoliatus Sweet, Hort. Brit. ed. 1, 251. 1826.
Specularia perfoliata A. DC., Monog. Campan. 351. 1830.
Triodanis rupestris Raf., N. Fl. N. Am. 4: 67. 1837.
Triodallus rupestris Raf. ex A. DC., in DC., Prodr. 7(2): 491, in syn. 1839.
Dysmicodon perfoliatum Nutt., Trans. Am. Phil. Soc. n. s. 8: 256. 1843.
Pentagonia perfoliata Kuntze, Rev. Gen. 381. 1891.
Legouzia perfoliata Britton, Mem. Torrey Bot. Club 5: 309. 10 Oct. 1894.

Exceedingly variable in size, posture, and vestiture, the stems mostly 30–60 cm. high and 1–3 mm. in diameter, but sometimes more than 1 m. high or in poor soil only 5–8 cm. high and then very slender; stems usually erect (sometimes decumbent or prostrate in woods and wet places), the base pilose to hispid with white hairs up to 1.5 mm. long, the upper parts pilose to hispid like the base, or the hairs shorter and the stems retrorsely hispidulous or scabrous. Leaves and bracts densely ciliate with short broad-based sharp hairs, beneath scabrous, or vestite like the stems (at least near base on the principal veins), or the bracts smooth and glabrous except for the margins; blades of the median foliage leaves sessile, ovate-cordate, the lower varying to broadly elliptic with abruptly contracted

base, the lowest (often withered at flowering time) obovate with attenuate base or with distinct elliptic or suborbicular blade and slender petiole up to 1.5 cm. long; all blades blunt or rounded at tip, often somewhat undulate-crisped, coarsely to obscurely crenate with 3–6 teeth on each side, mostly 1.5–2 times as long as wide, up to about 2.5 cm. wide and 3.5 cm. long; bracts relatively much broader and more coarsely toothed, ovate to reniform, sessile and usually strongly cordate-clasping and concealing the fruit, the tip blunt (in shade forms sometimes rounded and the bract as a whole suborbicular) to abruptly acute and mucronate, the median (0.5) 0.6–0.8(–1.0) times as long as wide, up to about 3 cm. wide and 2–2.5 cm. long, crenate with about 4–6(–10) teeth on each side (in some forms varying to almost entire or to sharply serrate). Flowers in average plants at the upper 20–35(–60?) nodes, the lowest 6–20(–40) (or usually $\frac{1}{3}$–$\frac{2}{3}$ of all fertile nodes) bearing cleistogamous flowers, the upper nodes usually bearing open flowers; terminal flower usually open; axillary flowers 1–3 (or up to about 8) at a node. Corolla of the cleistogamous flowers less than 0.5 mm. high; opening corollas bluish-lavender (in rare individuals white), 8–12(–13) mm. long, the tube (1.5–)2–3.5(–5) mm. long, the lobes (2–)3–4.5(–5.5) mm. wide. Filaments 1.5–2.5 mm. long, the proximal half abruptly dilated. Anthers (2–)2.5–3.3 mm. long. Capsule at maturity quite smooth or retrorsely scabrous on the angles, usually obovoid or oblong, 1.5–2.5 mm. in diameter and 4–6(–8) mm. long (in the cleistogamous flowers) or up to 3.5 mm. in diameter and 10 mm. long (in the open flowers), in the open flowers sometimes somewhat sulcate and the pores sunken; pores broadly elliptic or rounded, the uplifted portion (0.6–)0.8–1.5 mm. wide, 1.5–3(–4) mm. long, tightly curled after opening, with narrow central cartilage and broad rounded scarious margins, its distal extremity 1–1.5(–2.5) mm. below the summit of the capsule (or rarely at the summit!); locules and pores 2 or 3 in the cleistogamous flowers. Style 5–7.5 mm. long, the branches 1–1.5 mm. long or less. Calyx-lobes triangular to lanceolate or ovate, with slender subulate tips, often with 1–2 capillary bristles at tips, glabrous or the margins scabrous-ciliate; lobes in the open flowers (0.7–)1.3–2.5 mm. wide, (4–)5–8.5 mm. long, those of the cleistogamous flowers 3–5 (usually 3 or 5) in number, variable in size in the same flower, 0.5–2 mm. wide, 1–4.5 mm. long. Seeds ellipsoid, brown, biconvex or slightly flattened on the sides, about 0.4 mm. wide, 0.5–0.6 mm. long, somewhat lustrous, either muriculate over the entire surface or the processes reduced in various degrees or apparently wanting, the surface of the seed then smooth and lustrous but not highly polished, broken by tiny irregularities.—In various habitats (but avoiding deserts and permanently wet soil) almost throughout the United States; often occurs as a weed in disturbed areas. British Columbia to southern Ontario and Maine, south to northern California and in the Sierra Madre to Chihuahua (and Sonora?); southern Mexico; occurs (perhaps as an introduction) in Jamaica and Hispaniola and in Ecuador; rare or uncommon along the northern borders of the United States and in the more arid portions of the Rocky

Mountain and Great Basin States; common in eastern United States and west to western Nebraska, Kansas and Oklahoma, and to the 100th meridian in Texas; not reported from Nevada, southern Florida, or southern Texas; flowers from April to July (sometimes earlier in Texas and in Florida); occurs at elevations up to 6000 feet (in Colorado).

Although this species, like most of its congeners, readily occupies disturbed areas throughout its range and is often regarded as a weed, it is by no means universally distributed. Its principal area of distribution is in eastern United States south of the Great Lakes and, like many other native species of the same area, its western limit is approximately at the 100th Meridian, it is absent from the southern tip of Texas and the southern half of peninsular Florida, and it is relatively rare or entirely absent from the glaciated zone across northern New England, northern New York and west to the prairies. In addition to this primary area of distribution, however, the species is apparently native along the mountain chains from Chihuahua, Arizona and western Texas to Montana and British Columbia, its western range thence extending south, chiefly along the Cascade Ranges, to northern California.

This species is represented in herbaria by relatively few collections from outside of the United States and Canada, and there is a possibility that it is not native in southern Mexico, South America, and the West Indies; it may have been introduced into these areas from the United States at an early date:

Specimens examined: MEXICO: CHIHUAHUA, Cañon del Río Piedras Verdes, *C. V. Hartman 685* (GH, US); MEXICO, Salto de Agua, *C. A. Purpus 1708* (GH, Mo, US); OAXACA, Chinantla, *Liebmann pl. mex. 9230* (Haun); PUEBLA, Boca del Monte, *G. Arsène 7096* (US), Tezuitlan, *C. R. Orcutt 4021*, in part (Mo); SONORA, Los Animos, *G. Thurber 328* in 1851 (GH); VERACRUZ, Las Vigas, *E. W. Nelson 17* (US), Atoyac, *E. Kerber 489* (US), km. 329, between Orizaba and Fortin, *I. K. Langman 3443* (USNA); Jalapa, *C. L. Smith 1665* (GH). JAMAICA: Abbey Green, *Orcutt 5175* (US), Cinchona, *Wm. Harris 12078* (GH, Mo, US). HISPANIOLA: STO. DOMINGO, prope Constanza in pineto, *von Tuerckheim 3345* (GH, IA, Mo, US). ECUADOR: Pichincha, ad flum. Machangara pr. Quito, *I. Holmgren 523* (US), Perucho, *W. Jameson 642* (ANS); [the type of *Campanula flagellaris* H.B.K. (not seen by me) was collected "inter Quito et Puembo"].

It has been supposed, or at least inferred, by many writers, that plants of this species producing no open flowers were reproducing normally and producing normal viable seeds. Trent has found, however (1942), that although sporogenesis and embryogeny are similar in the two types of flowers, the open flowers produce approximately 47.5% viable seed, while the seeds of cleistogamous flowers germinate in but 0.07% of the samples tested. Ungerminated seeds, when sectioned, are usually found to be without embryo, although apparently normal in appearance and with fully developed endosperm.

Although *Triodanis perfoliata* is exceedingly variable in vegetative

characters, most of the variation is probably related to conditions of the habitat; variations in stems, leaves and pubescence appear to be those usually associated with modifications of local conditions, and show no correlation with regional distribution. Often two plants on the same herbarium sheet are superficially very dissimilar, one perhaps strict and markedly pubescent, the other decumbent and weak and more nearly glabrous. The flowers and fruits show very little variation from plant to plant, except as their size may be increased in vigorous individuals. The one exception so far discovered is in the seeds; as this seed-character seems to be correlated with regional distribution, although not with any other morphological character, it may be of some significance.

The seeds of *Triodanis perfoliata* are about 0.5 mm. long and a little longer than wide, plump, irregularly lenticular, with thin blunt edges; under a magnification of about 15 diameters they appear smooth, with a dull or slightly lustrous surface. With a magnification of 20 diameters, a good source of light, and a white background, however, it may be seen that the surface is thickly beset with minute erect dark points—one of my colleagues suggests that these resemble a heavy crop of sprouting whiskers—these are the muriculate seeds referred to in the description of this species. Not all plants have muriculate seeds, however. On seeds of some individuals the spinulose processes are so reduced as to be invisible except under higher magnification, and then are sometimes found only on the margins of the seed. On seeds of other plants the surface appears to be entirely smooth and without irregularity except that close inspection will often disclose what appear to be minute flat spots or perhaps depressions on the surface; the mass effect of these seems to be the dispersal of the reflected light from the surface, so that even these smooth seeds are considerably less lustrous than the seeds of *Triodanis biflora*, which they resemble otherwise.

Fortunately for the investigation of this character, mature or nearly mature seeds are available in practically all herbarium specimens of this species. On the other hand, ample suites of specimens are not available from many areas, so that it is not always possible to ascertain the relative abundance of smooth- and muriculate-seeded plants from an area. It has been possible, however, to make the following generalizations:

In the eastern Great Plains states, north to Kansas and Missouri and east to the Mississippi River, plants with muriculate seeds predominate in the following approximate ratios:

State	Ratio of muriculate/smooth seeds	Number of plants examined
Kansas	15/1	65
Missouri	11/1	85
Oklahoma	9/2	94
Arkansas	12/1	25
Texas	14/1	105
Louisiana	9/2	22

In the southern Rocky Mountains approximately the same ratios prevail, but the evidence is less conclusive because of the fewer specimens available:

State	Ratio of muriculate/smooth seeds	Number of plants examined
Utah	3/0	3
Colorado	5/1	20
Arizona	8/1	9
New Mexico	6/1	7

North and east of these areas plants with smooth seeds are much more frequent; throughout most of the states east of the Mississippi River the two types occur in approximately equal numbers, both often at the same locality as indicated by their presence on the same herbarium sheet. Apparently the muriculate type preponderates in the inland states south of the Ohio River and the smooth type becomes most abundant on the southeastern Coastal Plain and in areas most recently glaciated. The smooth type occurs almost to the exclusion of the other along the northern edge of the range of the species, except in the Rocky Mountains, where both occur. The following table gives the ratios for the eastern states and smaller areas discussed above; the ratio was approximately 1/1 for a small number of specimens in those states not included:

State	Ratio of muriculate/smooth seeds	Number of plants examined
Georgia (Piedmont except 1 plant)	7/0	7
Tennessee	7/2	9
Kentucky	6/0	6
West Virginia	4/1	5
Pennsylvania	5/6	55
New Jersey (Coastal Plain)	1/4.3	32
Delaware	0/2	2
Maryland (eastern)	1/4	10
District of Columbia	1/1	22
Florida	1/3	20

Conditions in the northwestern states and in British Columbia may be tabulated as follows:

State	Ratio of muriculate/smooth seeds	Number of plants examined
British Columbia	0/4	4
Washington	0/19	19
Oregon	1/1	10
California	0/3	3
Idaho	5/7	12
Montana	3/2	5
Wyoming	1/5	11
North Dakota	———	0
South Dakota	0/10	10
Minnesota	1/2	3
Iowa	1/7.5	48
Nebraska	1/1	14

In New England, where the species is relatively less frequent than in the central states, the tabulation is as follows:

State	Ratio of muriculate/smooth seeds	Number of plants examined
Maine	1/2	3
New Hampshire	1/2	3
Vermont	0/3	3
Massachusetts	1/2	22
Rhode Island	1/2	3
Connecticut	1/2	9

North of Kansas and Missouri plants with muriculate seeds are rarely found; apparently there is an abrupt termination of range here. The ratios for Missouri and Iowa, for example, show a complete reversal in the relative abundance of the two types in these two states. Presumably the figures for Kansas and Nebraska would be similar, but very few specimens from Nebraska have been available.

The above data may be interpreted tentatively as follows: This species originally occupied a part or all of the Appalachian-Ozarkian region of eastern United States. Its seeds were all or principally of the muriculate type. Plants with seeds of this type early became established in suitable situations in the Rocky Mountains as well as in the eastern prairies and forested areas. More recently the smooth-seeded type has developed and has spread onto the southeastern Coastal Plain and northward into glaciated territory more extensively than plants of the original type. It is possible that this smooth-seeded type may be a polyploid, since polyploid variants of otherwise diploid species are in many instances known to occupy new areas more rapidly than the original diploids.

The accompanying map (fig. 2) shows the distribution of the two forms of *Triodanis perfoliata*, each dot representing an actual specimen from the locality. The apparently great relative abundance of the species in Kansas, Oklahoma, and Texas is due at least in part to the fact that collectors in these states have been active, while in Nebraska, for example, but little collecting has been done. It seems probable, however, that this is essentially a prairie species, represented by most individuals in most localities in the states from Iowa and Nebraska southward, so that the picture given by the map may not be as misleading as may appear at first glance.

Mention was made above, in the discussion devoted to *Triodanis biflora*, of the plants which appear to be intermediate between this species and *T. perfoliata*. These intermediates are relatively few; as far as can be ascertained from material in herbaria they comprise less than 1 percent of the combined populations of the two species. The supposed intermediate nature of any individual plant is suggested chiefly by some aberrance in one or more of the following: number of open flowers, position of the opening in the capsule, degree and nature of surface roughness of the seeds, and shape and venation of the bracts. Certain plants perhaps appear intermediate because of dwarfing or the reverse, induced by conditions of the habitat: it is difficult to say, at least in herbarium material, whether a

plant is a dwarfed, narrow-bracted and smooth-seeded form of *T. perfoliata* in which the open flowers have been reduced to 1 by adverse conditions, or whether it is an intermediate form having the bracts and inflorescence of *T. biflora* and the capsules of *T. perfoliata*. On the other hand, certain luxuriant plants have the numerous open flowers of *perfoliata* and rather broad leafy bracts, but the other features of *biflora;* if these are of mixed

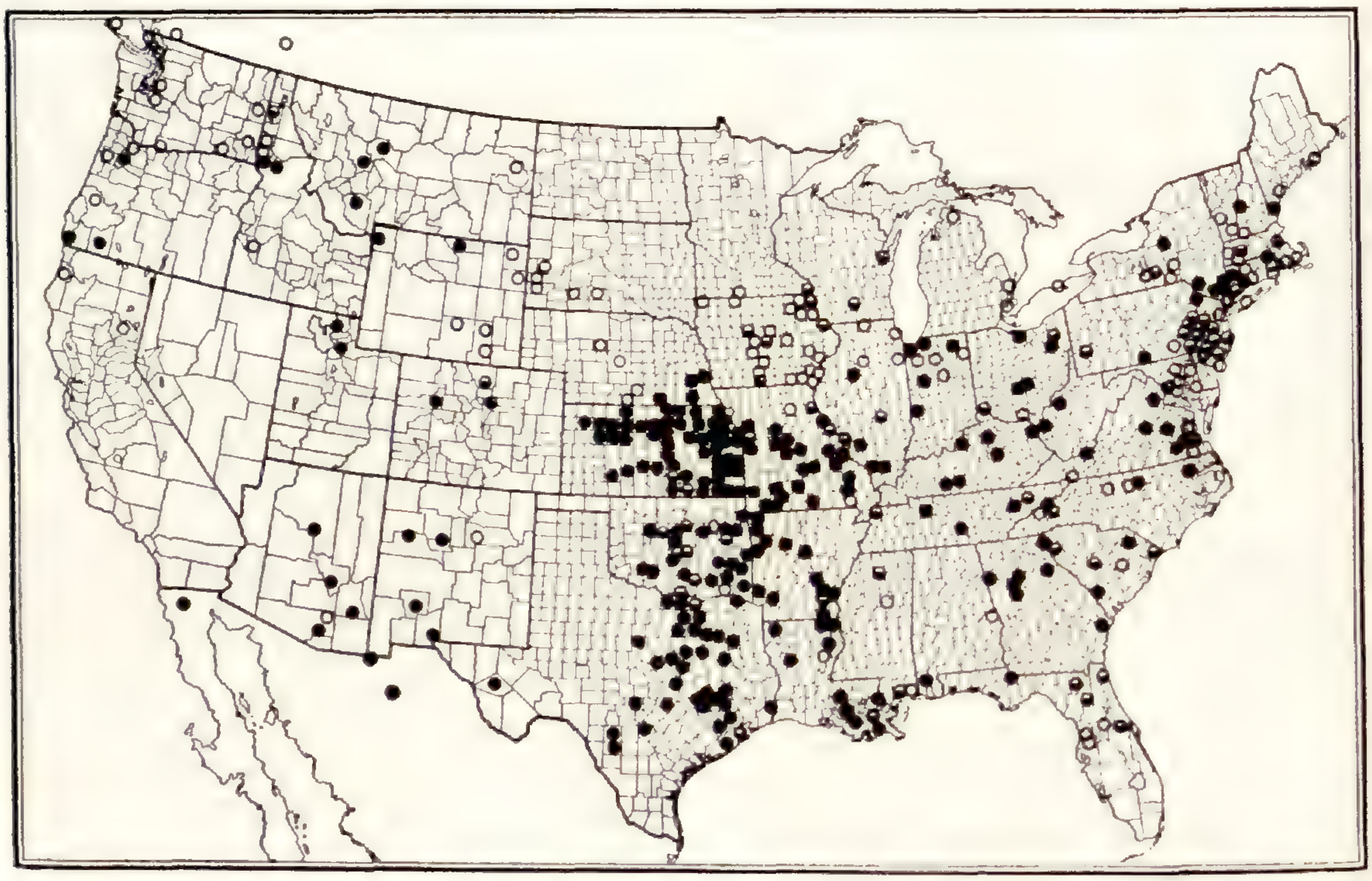

Fig. 2. The distribution of *Triodanis perfoliata* in the United States and adjacent Canada and Mexico. Solid dots indicate the occurrence of the form with muriculate seeds, open circles the form with smooth seeds; half-open circles indicate the occurrence of both forms in the same county or parish.

parentage, certainly they owe most of their characteristics to *biflora.* Herbaria contain very few specimens that can be interpreted as possible intermediates between *perfoliata* and *biflora*. The following have been seen:

LOUISIANA: Acadia Par., Crowley, *D. E. Ellis 20* (LSU; bracts intermediate; infl. of *perfoliata;* caps. of *biflora*); East Baton Rouge Par., Baton Rouge, collector & date unknown (LSU; dwarfed, bracts narrow, open fl. 1, caps. of *perfoliata*, seeds rough but not muriculate). TEXAS: Bexar Co., San Antonio, *G. Jermy 345*, in part (GH; 2 plants are *perfoliata;* 3rd has bracts like *perfoliata* but more pointed; infl., caps. and seeds of *biflora*). Brazos Co., College Station, *R. G. Reeves 71, 72* (USNA; infl. of *perfoliata;* otherwise *biflora* but bracts rather broad); Denton Co., 3 mi. s. w. of Denton, *W. L. McCart 1003* (NTSTC; infl. & bracts of *perfoliata;* caps. & seeds of *biflora*).

Relatively more frequent, at least in herbaria, than the supposed intermediates between *T. perfoliata* and *T. biflora*, are plants which seem to combine the characters of *T. perfoliata* on the one hand, and *T. texana* or

T. Holzingeri. This is presumably to be expected, if these intermediate plants are the result of hybridization, since *T. perfoliata* seems less closely related to *T. biflora* than to the others. In eastern Texas, where in some localities all 4 species occur, there are rather numerous individuals of a type that is not referable to any of the species. These plants usually have several or many of the upper nodes bearing open corollas; the bracts are often as broad as long, and 5-nerved, but more narrowly and acutely pointed than in *T. perfoliata*, suggesting in this respect *T. biflora* or *T. Holzingeri;* the capsule opens near the middle or slightly above it; the seeds are usually obscurely tuberculate, rather than either smooth or muriculate, and are usually prominently umbonate. Specimens of this general type are:

TEXAS: Without definite locality, *C. Wright* (GH); Bexar Co., San Antonio, *V. Havard* in 1884 (US); Brazos Co., without loc., *R. G. Reeves 1421*, south of F. & B. station, *Reeves 72A*, Bryan, *Reeves 18A*, near Jones Bridge, *Reeves 869, 869B*, College Station, *U. H. Williams* 4/18/39, in part, 4/24/39 (all TA&M); Brooks Co., s. of Encino, *C. L. Lundell & Amelia A. Lundell 12767*, in part (SMU; 1 plant typical *Holzingeri*, 5 are intermediates); Burleson Co., Lyons, *W. German s. n.*, in part (Tex); Cameron Co., without loc., *Mrs. A. M. Davis* in 1942, in part (Tex); Goliad Co., Goliad, *Rev. C. B. Williams 117* (ANS, Tex); Gregg Co., without loc., *Biltmore herb. 968e*, in part (US); Grimes Co., Navasota, collector unknown [Flower Contest] in 1934 (Tex); Harris Co., Buffalo Bayou, Houston, *J. F. Joor* in 1876 (LSU), Houston, *G. L. Fisher 57*, in part (US), Hockley, *F. W. Thurow 20* (US); Lee Co., 13 mi. n.e. of McDade, *R. R. Innes 879* (GH); Llano Co., Granite Mt., *B. C. Tharp* in 1931 (Tex); Walker Co., Huntsville, *M. S. Young* in 1914, in part (Tex); Washington Co., without loc., *E. Brackett s.n.*, Apr. 30 (Tex); Willacy Co., 1 mi. n. Sebastian, *R. Runyon 2515* (Runyon), end of highway, *Runyon 1610* (Runyon).

Specimens which appear surely to combine the characters of *T. perfoliata* and *T. Holzingeri* are listed below (see also *Lundell & Lundell 12767*, above). These have the relatively narrow, pointed, and stiff bracts of the latter species, but the capsule openings are intermediate in width between the two species:

TEXAS: Bell Co., Taylor's Valley, *S. E. Wolff 2950*, in part (TA&M; a plant of typical *Holzingeri* forms part of the same collection); DeWitt Co., without loc., *M. Riedel* in 1942 (Tex); Erath Co., without loc., *L. C. Gough* in 1921, in part (Tex; also a plant of *Holzingeri*); Kleberg Co., Kingsville, *J. F. Sinclair* in 1940, in part (Tex, GH, also a plant of *Holzingeri* on the Gray Herbarium sheet); Maverick or Valverde Co., Del Rio to Eagle Pass, *E. Whitehouse* in 1934 (Tex).

A few specimens appear certainly to combine the characters of *T. perfoliata* and *T. texana*. Plants of typical *texana* are mounted on the sheets with each of the supposed intermediates cited below:

TEXAS: Brazos Co., near Jones Bridge, *R. G. Reeves 869A* (TA&M); this collection consists of 1 plant of *T. biflora*, 1 of *T. texana*, and 2 resembling

texana but with acute bracts, the seeds nearly smooth, more or less quadrangular; Van Zandt Co., n.w. of Edom, *C. L. Lundell & Amelia A. Lundell 10456* (SMU); this collection consists of 1 plant of *T. perfoliata*, 1 of *texana*, and 1 resembling *perfoliata* except that the seeds are smooth but longitudinally lined; this latter plant is intermediate in degree of pubescence between *perfoliata* and *texana*.

5. **Triodanis lamprosperma** McVaugh, sp.nov.

Habitu *T. perfoliatae;* bracteae plerumque serratae, capsula apice dehiscens; semina nitida, 0.8–1 mm. longa.

Erect, the stems (15–)30–60(–85) cm. high and up to 4 mm. in diameter, the base pilose to hispid or retrorsely scabrous, the upper parts retrorsely scabrous to entirely glabrous. Leaves and bracts scabrous or hispid beneath at least on the veins near base (or the bracts glabrous and smooth on both surfaces), finely and densely ciliate with very short broad-based hairs except near base, where pilose with slender white hairs up to 1.5 mm. long; blades of the foliage leaves sessile, oval, or the lowest obovate and attenuate into a short petiole, all rounded at tip and crenate with about 6 teeth on each side, 1.3–2 times as long as wide, mostly 7–12 mm. wide and 8–25 mm. long; bracts relatively and actually broader, ovate to reniform, sessile and often strongly clasping and usually concealing the fruit, bluntly pointed (often abruptly acute and mucronate), the median mostly 0.6–1 times as long as wide, 10–25 mm. wide, 8–16 mm. long, uniformly crenate-serrate with 3–7 teeth on each side, the teeth up to 1.5 mm. high. Flowers at the upper 15–50 nodes, the lowest (6–)12–25(–40) fertile nodes (or usually ¼ to ⅔ of all fertile nodes) bearing cleistogamous flowers, the upper nodes usually bearing open flowers; terminal flower often aborting; axillary flowers 1–3 at a node, the terminal of the trio usually maturing, the laterals often aborting. Corolla of the cleistogamous flowers less than 0.5 mm. high; opening corollas probably bluish-purple, 9–12 mm. long, the tube 1.5–2.5(–4) mm. long, the lobes 4–5 mm. wide. Filaments 1.8–2 mm. long, the proximal half abruptly dilated. Anthers 2.5–3 mm. long. Capsule at maturity retrorsely scabrous on the angles to nearly or quite smooth, usually obovoid or oblong, 1.5–2 mm. in diameter and 4–6(–7) mm. long (in the cleistogamous flowers) or 2.3–3 mm. in diameter and 7–10 mm. long (in the open flowers), in the open flowers often sulcate and the pores somewhat sunken; pores broadly elliptic or rounded, at the distal extremity of the capsule, 0.7–1.3 mm. wide, 1.4–2.5 mm. long, with narrow central cartilage and broad rounded scarious margins, usually tightly curled after opening; locules and pores predominately 2 in the cleistogamous flowers. Style 5.7–7.2 (usually about 6.5) mm. long, the branches 1 mm. long or less. Calyx-lobes triangular (or in the corolliferous flowers often truly lanceolate and then broadest 2–3 mm. above base), with slender subulate tips, usually with 1 or 2 capillary bristles at tips, glabrous or the margins scabrous-ciliate, in the open flowers 0.8–1.6(–2.5) mm. wide, 5.5–9 mm. long, those of the cleistogamous flowers 3–5, (0.7–)1–1.7 mm. wide, (1.8–)2.5–4 mm. long. Seeds smooth and highly polished,

biconvex or slightly flattened on the sides, 0.6–0.8 mm. wide, 0.8–1.0 mm. long (usually about 0.7 mm. wide and 0.8 mm. long).—Dry rocky ridges and ledges, open rocky woods, glades, moist woods and flood-plains, flowering and fruiting from early May to mid-June; southern Missouri, western Arkansas and eastern Oklahoma, at elevations up to 2800 ft.

Type in the Gray Herbarium, Harvard University, collected May 6, 1940, by Delzie Demaree (no. 21152), on dry rocky ridges of Fourche Mountain, Little Rock P.O., Pulaski Co., Arkansas, at 500 feet elevation; isotypes in the herbaria of the Missouri Botanical Garden and Iowa State College.

Additional specimens examined: MISSOURI: Barry Co., Eagle Rock, *E. J. Palmer 30434* (Mo); Iron Co., Iron Mountain Lake, *J. H. Kellogg 1216* (Mo); Jasper Co., Carterville, *Palmer 2148* (Mo), Neck City, *Palmer 3962* (Mo); Shannon Co., Monteer, *B. F. Bush 432* (GH, Mo). ARKANSAS: Logan Co., Magazine Mt., *D. Demaree 17725, 21309* (Mo); Yell Co., Mt. Nebo State Park, *Demaree 21285* (Mo). OKLAHOMA: Haskell Co., without loc., *R. Bebb 5471* (Okla); Latimer Co., e. of Gowen, *O. Clark 2696*, in part (Okla); Leflore Co., Kiamichi Mts., *T. Johnson 96* (Okla), near Stapp, *Hopkins & VanValkenberg 4283* (Okla); McCurtain Co., Garvin, *Demaree 12645* (Okla), swamp of Little Creek, Eagletown, *Hopkins & VanValkenberg 4192*, in part (Okla).

This species has previously been confused with *T. perfoliata*, but it seems undoubtedly distinct, with a well defined range in the Ozark-Ouachita region. Vegetatively it may usually be distinguished from *T. perfoliata* by the conspicuously serrate and imbricate bracts and the relatively smooth upper portions of the stems.

6. **Triodanis texana** McVaugh, sp.nov.

T. perfoliatae similis, sed inferiore parte caulis et faciebus inferioribus foliorum inferiorum conspicue hirsutis; semina quadrangularia, rugoso-reticulata.

Slender, erect or reclining at base, the stem 10–75 (usually 25–50) cm. long, 1–1.5(–4.5) mm. in diameter, hirsute below with colorless flaccid hairs up to 1 mm. long, densely so on the angles and often between them, the hairs much reduced above and the upper parts of the stem retrorsely hispid or merely scabrous. Lower leaves hirtellous to hirsute beneath especially on the veins, the upper foliage leaves and all bracts sparsely hirtellous to (often) perfectly glabrous except the margin, which in all leaves and bracts is ciliate with short stiff broad-based hairs; blades of the foliage leaves sessile or the lower with attenuate bases, the uppermost (immediately below the floriferous nodes) ovate, the median elliptic, the lowermost oblanceolate to obovate, all rounded or obtuse at tip or the uppermost blunt-pointed, all uniformly crenate from tip to near base with 4–6 (9) teeth on each side, mostly 1.5–2.5 times as long as wide, mostly 6–15 mm. wide, (10–)15–30(–40) mm. long; bracts relatively broader, ovate, sessile and somewhat clasping, obtuse to sharply acute and often

mucronate at tip, often spreading and exposing the fruits, the middle ones mostly 0.7–1.0 times as long as wide (rarely twice as long as or only about half as long as wide), 6–17 mm. wide, 4–22 mm. long, the margins rather uniformly crenate with 3–8 teeth on each side (in very small bracts the teeth reduced to glandular callosities). Flowers in the upper 10–30(–40) axils, the lowest fertile nodes (usually 5–15, or ⅓–⅔ of all fertile nodes) bearing cleistogamous flowers only, the upper nodes usually bearing open flowers; terminal flower open or cleistogamous; axillary flowers 1–3 at each node, usually 1 only (the terminal) maturing fruit, the two laterals usually aborting. Corolla of the cleistogamous flowers less than 0.5 mm. high; opening corollas probably bluish-purple, glabrous, 7–10(–14) mm. long, the tube 1.5–2.5(–4) mm. long, the lobes 2–5 mm. wide. Filaments 1.5–2.2 mm. long, the proximal half gradually or abruptly dilated. Anthers (1.7–) 2.1–3 mm. long. Capsule at maturity glabrous or sparsely hirtellous, ellipsoid or ovoid or in the open flowers truncate and clavate, 1.5–2.5 mm. in diameter, 4–6(–7) mm. long, the oval pores about the middle of the capsule (1–2.5 mm. below the base of the calyx-lobes), 0.7–1(–1.6) mm. wide, (1.5–)2–3 mm. long, with narrow central cartilage and broad scarious margins, tightly curled after opening; locules and pores usually 2 in the cleistogamous flowers. Style 5–7.5 mm. long, the branches 1 mm. long or less. Calyx-lobes triangular or triangular-ovate, acutely pointed and often mucronate, or with a capillary tip, glabrous or sparingly ciliate like the bracts, erect or spreading in fruit, those of the open flowers 0.9–1.5(–2) mm. wide, 3–6(–7) mm. long; those of the cleistogamous flowers 3–5, 0.5–1.2 mm. wide, (1–)1.5–3 mm. long, often all alike, but sometimes 1 or 2 smaller than the others. Seeds dark chestnut-brown, lustrous, 0.2–0.3 mm. in diameter, 0.4–0.6 mm. long, more or less quadrangular with usually concave or flat sides and obtuse angles, the surface roughened with low narrow anastomosing ridges in longitudinal rows.—In woods, pinelands, plains, open banks and depressions, mostly in sandy soils, flowering in April and May; eastern Texas.

Type in the herbarium of the Missouri Botanical Garden, no. 828770, collected April 26, 1917 by E. J. Palmer (no. 11697), in sandy open ground at Somerville, Burleson Co., Texas; isotypes in the Rocky Mountain Herbarium of the University of Wyoming and in the herbarium of Iowa State College.

Additional specimens examined: TEXAS: Bastrop Co., Bastrop to Elgin, *B. C. Tharp* in 1940 (Tex); Brazos Co., *R. G. Reeves 869A*, in part (TA&M); Caldwell Co., without locality, *J. B. McBryde* in 1931 (Tex); Dallas Co., Dallas, *J. Reverchon 2087* (Mo), *B. F. Bush 680* in 1900 (Mo, US); Erath Co., without locality, *L. C. Gough* in 1921 (Tex); Fayette Co., Colony, *E. W. Crawford 38* (US), *41* (Mo); Frio Co., Moore, *E. J. Palmer 33880*, in part (GH, IA, Mo); Gonzales Co., Ottine, *E. R. Bogusch* [UTex 1435] (Tex), *Tharp* in 1935 (GH), Gonzales, *H. B. Parks & V. L. Cory 8369* (TA&M), without locality, *Bogusch* [UTex 1433] (Tex); Hardin Co., Fletcher, *Palmer 9550* (IA, Mo); Milam Co., Between Milano & Gause, *S. E. Wolff 4010* (TA&M); Travis Co., Austin, *Tharp* in 1935 (GH); Van Zandt Co., Edom, *C. L. Lundell & Amelia A. Lundell 10456*, in part (SMU).

Superficially this plant is little different from *T. perfoliata* except in the seeds, but it also differs from that species in its more hirsute lower stems and lower leaves, its nearly glabrous bracts and upper stems, and its somewhat shorter calyx-lobes. Apparently it may be associated in nature with *T. perfoliata* and sometimes with *T. Holzingeri*, as herbarium sheets occasionally bear both or all three together.

7. **Triodanis Holzingeri** McVaugh, sp.nov.

Habitu *T. perfoliatae*, sed strictior et bractibus plerumque adpressis et acutis; capsula versus mediam partem valvulis linearibus dehiscens; semina tuberculata.

Slender, erect, the stem 25–60(–85) cm. high, up to 4 mm. in diameter, strict and simple or with few branches, the base hispid or hirsute with stiff or flaccid colorless hairs up to 1 mm. long, the upper parts retrorsely hispid or merely scabrous. Leaves and bracts scabrous beneath with short broad-based hairs chiefly on the veins or the bracts essentially glabrous; blades of the foliage-leaves sessile or the lower with attenuate bases, the uppermost ovate, the median elliptic, the lowermost oblanceolate or obovate, all rather blunt-tipped with a rounded point and a very short glandular mucro (the uppermost acute), all more or less undulate-crisped and uniformly crenate from base to apex with 5–8 teeth on each side, mostly 1.6–2.5(–3.2) times as long as wide, mostly 5–10(–13) mm. wide, (10–)16–24(–30) mm. long; bracts relatively broader, ovate, sessile and somewhat clasping, sharply acute and often mucronate at tip, often more or less appressed in fruit or only the tips spreading, often exceeded by the mature capsules, the median mostly 1–1.5 times as long as wide, (5–)7–15(–20) mm. wide, 7–20 mm. long, the margins uniformly crenate from base to apex with 3–6 teeth on each side, or the distal third entire, deltoid; margins of the foliage-leaves ciliate with short broad-based hairs; margins of bracts glabrous or similarly vestite, but often revolute except at base and so appearing glabrous. Flowers at the upper 20–50(–85) nodes, the lowest 10–50 fertile nodes (usually 15–30, or ⅓ to ⅔ of all fertile nodes, but often all fertile nodes) bearing cleistogamous flowers, the upper nodes usually bearing open flowers; terminal flower open or cleistogamous; axillary flowers 1–3 at a node, the terminal usually maturing fruit, the laterals often aborting. Corolla of the cleistogamous flowers less than 0.5 mm. high; opening corollas probably bluish-purple, glabrous or with coarse hairs without on the midveins of the lobes, 7–9(–11) mm. long, the tube 1–2(–2.5) mm. long, the lobes 2–3(–5) mm. wide. Filaments about 1.6–2 mm. long, the proximal half gradually or abruptly dilated. Anthers 2–2.6 mm. long. Capsule at maturity scaberulous to essentially glabrous, ellipsoid or oblong or in the open flowers truncate and obovoid, often strongly angled, 0.7–1.5 mm. thick and 2–2.5 mm. wide (when bilocular) or 1.5–2.5 mm. in diameter (when trilocular), (3.5–)6–8(–12) mm. long, often deeply sulcate between the locules and the pores thus sunken; pores linear, about the middle of the capsule (1–2.7 mm. below the base of the calyx-lobes or rarely less than 1 mm.), 0.2–0.4(–0.5) mm. wide, 1.4–2.5 mm. long,

the cartilage filling the entire width of the pore, or with very narrow scarious margins, after opening divaricate or curved into an open ring; locules and pores predominately 2 in the cleistogamous flowers. Style 4.5–6 mm. long, the branches 1 mm. long or less. Calyx-lobes triangular or triangular-ovate, acute and often attenuate-falcate, often with 1 or 2 capillary bristles at tip, glabrous, or scabrous on midrib without, or on midrib and margins, often recurved-spreading in fruit, those of the open flowers 1–1.5(–2.5) mm. wide, 4–6(–7.5) mm. long; those of the cleistogamous flowers 3–5, 0.7–1.5(–2.5) mm. wide, (1.5–)2.5–6 mm. long, often either 3 or 5 and all alike, but sometimes 1 or 2 smaller than the others. Seeds dark chestnut-brown, lustrous, lenticular, about 0.25–0.4 mm. wide, 0.4–0.7 mm. long, minutely low-tuberculate in longitudinal lines.—Open prairies and plains, river bottoms, canyons, in sandy and gravelly soils, flowering and fruiting from May to July (or earlier in southern Texas and Arizona). Southeastern Wyoming to western Missouri, south in the prairies to southern Texas; with outlying stations in western Tennessee and southeastern Arizona.

Type in the herbarium of the National Arboretum, no. 102701, collected on open prairies near Washington, McClain Co., Oklahoma, June 12, 1936, by Milton Hopkins and C. T. Eskew (No. 688 of the Plantae Exsiccatae Grayanae).

Additional specimens examined: LOCALITY UNKNOWN: Rocky Mts., *C. Thomas*[4] in 1869, in part (US). ARIZONA: Graham Co., 8 mi. s.w. of Safford, *B. & R. R. Maguire 11766* (GH); Pima Co., Tucson, *M. Zuck* in 1896 (US), *J. W. Toumey* in 1894 (GH, US), "Catalina Mts. near Tucson," *V. L. Cory 3511* (GH), Santa Rita Mts., *C. G. Pringle*[5], "April and May, 1881," in part (Mo). KANSAS: Barber Co., Medicine Lodge, *A. S. Hitchcock* in 1892 (Kans); Cloud Co., ?Aurora, *S. V. Fraser 384* (Kans); Ellsworth Co., Kanopolis, *M. Becker* in 1896 (Kans); Gray Co., without locality, *Hitchcock* in 1897 (Kans); Seward Co., Liberal, *Hitchcock* in 1892 (Kans). MISSOURI: Jackson Co., without locality, *B. F. Bush* in 1888 (Mo), Courtney, *Bush 120* in 1899 (Mo), *Bush 6846* in 1912 (GH, Mo, US), Sheffield, *Bush 429* in 1895 (Mo). NEBRASKA: Thomas Co., Dismal R., s. of Thedford, *P. A. Rydberg 1346*, in part (US). OKLAHOMA: Blaine Co., Greenfield, *J. Engleman 197* (Okla); Caddo Co., Devil's Can., near Hinton, *G. W. Stevens 946* (GH, Mo, US); Cleveland Co., near Norman, *F. L. Hambrick 33*, *C. Whaley 26*, *C. C.*

[4] The collector's name is given thus on the label. This is Cyrus Thomas (1825-1910), later an eminent ethnologist. In 1869 he undertook the post of entomologist and botanist to the Hayden Survey. A catalogue of the plants collected in 1869 was published by C. C. Parry in the Report of the Hayden Survey for 1870, pp. 484-487, but nothing is known in regard to the localities where they were collected, except as these may be inferred from the route of the Hayden party as given in the report for 1869. The specimen of *Triodanis Holzingeri* cited above was probably collected in June, somewhere along the line of the railroad between St. Joseph, Missouri, and Cheyenne, Wyoming.

[5] The source of Pringle's material may be questioned, as the sheets of this collection distributed in different herbaria bear not only this species, but also *T. perfoliata* and *T. biflora*, and the collector evidently assembled the material over a period of some weeks and perhaps from several localities, in the assumption that it was all the same species.

Smith 484, C. T. Eskew 1018, 1813, Hopkins & Cross 117 (all Okla); Custer Co., Cedar Twp., *L. Mericle 647* (Okla), Barnitz Twp., *Mericle 494* (Okla); Ellis Co., Shattuck, *R. L. Clifton* [*Stevens 3120*] (GH); Greer Co., Mangum, *R. Bull* in 1928 (Okla); Kingfisher Co., Lacey, *V. Young* [*Stevens 1565*] (GH); Kiowa Co., 4 mi. e. Headrick, *R. R. Innes & B. Moon 996* (GH, USNA); Logan Co., n.w. part of county, *C. C. Smith 677, 709, 736* (all Okla), without locality, *M. A. Carleton 167* in 1891 (US[6]), Guthrie, *Stevens 3221* (GH); Murray Co., Arbuckle Mts., *M. Hopkins 6052* (Okla); Noble Co., without locality, *P. J. White* in 1900 (R); Pottawatomie Co., St. Louis, *M. Faulkner 103*, in part (Okla); Woods Co., Alva, *Stevens 653* (GH, Mo, Okla, US), Freedom, *Stevens 726 1/2* (GH); Woodward Co., Fort Supply, *J. P. Kimball* in 1891 (Kans); County undetermined, between Ft. Cobb & Ft. Arbuckle, *E. Palmer 168* in 1868 (US). TENNESSEE: Shelby Co., President's Island, P. O. Memphis, *D. Demaree 21373* (Mo). TEXAS: Bell Co., Taylor's Valley, *S. E. Wolff 2950*, in part (TA&M); Bexar Co., San Antonio, *E. D. Schulz* in 1921 (Tex); Brewster Co., Alpine, *H. J. Cottle* in 1926 (Sul Ross), *E. J. Palmer 30525* (Mo, Tex), *E. L. Reed 1835* (US); Brooks Co., Encinal, *C. L. Lundell & Amelia A. Lundell 12767*, in part (SMU); Childress Co., Childress, *Childress H. S. s. n.* (Tex); Comanche Co., Comanche, *H. Eggert* in 1900 (Mo); Erath Co., Stephenville, *J. C. Brown 2* (Tex), *H. B. Parks & V. L. Cory 13171* (TA&M), without locality, *L. C. Gough* in 1921, in part (Tex); Frio Co., Moore, *E. J. Palmer 33880*, in part (GH, IA, Mo); Kleberg Co., Kingsville, *J. F. Sinclair* in 1940 (GH); Maverick Co., Eagle Pass, *C. G. Pringle 9184*, in part (GH, US); Midland Co., Midland, *E. Whitehouse* in 1932 (Tex); Mitchell Co., Colorado, *H. Eggert* in 1900 (Mo); Nueces Co., Corpus Christi, *C. R. Orcutt 5870* (Mo); Parker Co., Millsap, *E. Wadsworth* in 1927 (Tex); San Patricio Co., Mathis, *S. D. McKelvey 1720* (GH); Travis Co., Austin, *A. M. Ferguson* in 1901 (Tex), Lake Austin silt, *Whitehouse* in 1933 (Tex); Webb Co., sands, Laredo, *J. Reverchon* in 1903 (Mo); Wheeler Co., Mobeetie, *B. C. Tharp* [*UTex 6298*] (Tex, US, USNA); County undetermined, Valley of the Rio Grande below Doñana, *C. C. Parry et al.* [Mex. Bound. Surv. 697, in part] (US), Johnson City to Fredericksburg, *Whitehouse* in 1929 (Tex). WYOMING: Platte Co., Whalen Canyon, *A. Nelson 514* in 1894 (GH, R, US).

This species is named for John M. Holzinger (1853–1929), who seems to have been the first to suspect that plants of it were unlike those of typical *T. perfoliata*. In his account of Carleton's plants from the Indian Territory (1892), Holzinger associated Carleton's no. 167 with Palmer's no. 168, C. Thomas' collection from the Rocky Mountains, and no. 679 [i.e. 697] of the Mexican Boundary Survey; he considered all these the same peculiar "form of *S. perfoliata;*" all are now to be referred to *Triodanis Holzingeri*.

8. TRIODANIS LEPTOCARPA (Nutt.) Nieuwl., Am. Midl. Nat. 3: 192. 1914.

?Triodanis scabra Raf., N. Fl. N. Am. 4: 67. 1837.
Campylocera leptocarpa Nutt., Trans. Am. Phil. Soc. n. s. 8: 257. 1843.
Campanula leptocarpa Engelm. ex Nutt., Trans. Am. Phil. Soc. n. s. 8: 257, in syn. 1843.

[6] No locality is given on the label, but in Holzinger's account of Carleton's collections (1892, p. 210), the locality for this number is given as "Guthrie, Cimarron Valley."

Campylocera leptocarpa var. *glabella* Nutt., Trans. Am. Phil. Soc. n. s. 8: 257. 1843.
Specularia Linsecomia Buckl., Proc. Acad. Phila. 13[1861]: 460. 1862.
Specularia leptocarpa A. Gray, Proc. Am. Acad. 11: 82. 1876.
Pentagonia leptocarpa Kuntze, Rev. Gen. 381. 1891.
Legouzia leptocarpa Britton, Mem. Torrey Bot. Club. 5: 309. 10 Oct. 1894.

Slender, erect or reclining, the stems 10–50(75) cm. high and 1–2 (–3.5) mm. in diameter, the base spreading-hispid or retrorsely scabrous, the upper parts (occasionally) hispid or (usually) retrorsely scabrous to entirely glabrous. Leaves and bracts scabrous or prickly-hispid beneath at least on the veins, or the bracts smooth; leaves and bracts finely and more or less antrorsely ciliate with short broad-based hairs, these somewhat longer near the base of the blade; blades of the foliage-leaves sessile, elliptic to oblanceolate, or the lowest oblanceolate to obovate and attenuate into short petioles; blades acute and blunt-pointed, callose-tipped, or the lowest rounded, all inconspicuously callose-toothed or shallowly crenate with 3–6 teeth on each side, mostly 3–6 times as long as wide, 3–5(–8) mm. wide, 15–35 mm. long, the lower smaller and relatively broader; bracts lanceolate to linear, sessile, acute and callose-tipped, the median 3.5–10 (usually 6–8) times as long as wide, 2–6 mm. wide, 15–25 mm. long, callose-denticulate or crenate like the leaves, the lower bracts o ten conspicuous and longer than the sterile leaves. Inflorescence often very many-flowered with many and crowded flowering nodes but not appearing dense because of the spreading, slender capsules; flowers at the uppermost 15–50(–65) nodes, the lowest 10–35(–55) fertile nodes (or usually ½ to ¾ of all fertile nodes) bearing cleistogamous flowers, the upper nodes usually bearing open flowers alone, or both open and cleistogamous; terminal flower open, or often aborting; lateral flowers 1–7 in each axil, the terminal flower strongest; bracteoles linear, present at the bases of the weaker lateral flowers and usually even when these are abortive, but often completely wanting at 1-flowered nodes. Corolla of the cleistogamous flowers less than 0.5 mm. high; opening corollas "violet" (Pennell), mostly 7–10 mm. long, the tube 1.5–2 mm. long, the lobes 3–4 mm. wide. Filaments 1.5–2.3 mm. long, the proximal half abruptly dilated. Anthers (1.8–)2.2–2.8(–3.2) mm. long. Capsules prickly-hispid to retrorsely scabrous or quite smooth and glabrous, markedly dimorphic, those of the cleistogamous flowers terete, usually subulate, more or less falcate with divaricate tips and often spirally twisted, or straight and appressed, 0.7–1.5 mm. in diameter, 8–12(–20) mm. long, unilocular with parietal placentation, at length dehiscent in the distal half by longitudinal slits alternating with the calyx lobes, or less frequently by a single pore up to 2.5 mm. from the apex, 0.5–0.7 mm. wide and 1.7–2.6 mm. long, the relatively broad cartilaginous process broadly fusiform, occupying most or essentially all the opening, opening from base toward apex but ultimately free at both ends, curved into a half-circle but not tightly rolled; capsules of the open flowers usually straight and more erect, thicker and longer, 15–25 mm. long, linear,

terete and unilocular (and then usually dehiscent by slits only) and 1.3–1.8 mm. in diameter, or flattened and sulcate and imperfectly or perfectly bilocular (with one or 2 apical pores, respectively) and then 1–1.5 mm. thick, 2–2.5 mm. wide. Style (3.5–)5.5–6.5(–7.5) mm. long, the branches 1 mm. long or usually less. Calyx-lobes subulate, falcate or widely divaricate or ascending in fruit, glabrous or often somewhat ciliate like the leaves; lobes variable in length and width in both types of flowers, those of the open flowers 0.5–1 mm. wide, 6–10(–15) mm. long, those of the cleistogamous flowers 3–5 in number, 0.3–0.7 wide, 2–6(–10) mm. long; seeds light brown, smooth and lustrous, biconvex and somewhat flattened, with rounded ends, about 0.4–0.6 mm. wide, 0.7–1 mm. long.—Prairies, barrens, rocky open slopes and ridges, dry or moist woods, bottoms and draws, creek banks; mostly in limestone outcrops and glades, apparently beginning to flower in late April (in southern Texas) or mid-May (Oklahoma) and continuing throughout the summer; prairies from southern Texas to Montana, North Dakota and Minnesota.

This species is known from relatively few localities from the northern tiers of states:

MONTANA: Cascade Co., Sand Coulee, *R. S. Williams 310* (US); Gallatin Co., 16 Mile Creek, *Scribner 131* in 1883 (ANS, US), near Bridger Peak (Fort Ellis), *W. B. Platt* [Hayden Survey, 1872] (ANS, US); Park Co., Livingston, *E. W. Scheuber* in 1901 (IA). NORTH DAKOTA: Fort Berthold Indian Reservation, collector unknown, *no. 88*, in 1935 (USNA); Morton Co., Glen Ullin, *G. A. Holzinger 29* (US). MINNESOTA: Hennepin Co., Fort Snelling, *W. H. Forwood* in 1888 (US). WYOMING: Sheridan Co., Upper Little Goose, *V. Willits 228* (R). SOUTH DAKOTA: Meade Co., near Ft. Meade, *W. H. Forwood 245 1/4* (US), Bear Butte, *A. C. McIntosh 699* (R); Pennington Co., Cedar Pass near Interior, *E. J. Palmer 37646* (Mo); Tripp Co., twp. 99, *H. J. Rehorst* in 1938 (USNA), Winner, *W. H. Over 15838* (US). NEBRASKA: "Prairies, Mauvaises Terres," *F. V. Hayden* in 1853 (Mo; this probably came from the "Bad Lands" of what is now South Dakota, but the label is headed "Flora Nebraskana"). IOWA: Winnebago Co., without loc., *D. R. Porter* in 1923 (IA). COLORADO: Boulder Cañon, *W. A. Henry 191* (ANS); without loc., *C. C. Parry* in 1862 (IA), and 1864 (Mo).

In Kansas this species is abundant and common except in the western fifth of the state, and is equally so in Oklahoma except possibly in the extreme northeast and in the counties immediately east of the Texas Panhandle. In Texas it is known to occur in Bexar, Collin, Dallas, Llano, Palo Pinto, Parker, Tarrant, and Travis counties.

Along the eastern edge of its range it occurs in southwestern Missouri (Benton, Cass, Cedar, Dade, Jackson, Jasper, Polk, St. Clair, and Washington counties) and is said to be introduced in Macon Co. (Ethel, *B. F. Bush 7607* in 1915, Mo). It is known to me from a single locality in Arkansas (Logan Co., Magazine Mt., *Demaree 17724, 21331*, Mo), and it has been reported by Deam (1940, p. 1094) as a weed along the railroad in Indiana.

No type-material of *Campylocera leptocarpa* has been found at Phila-

delphia, unless a collection made by George Engelmann at Fort Gibson, Arkansas (now Oklahoma), in June, 1835, be taken for the type. This collection was designated by Engelmann as his new *Campanula leptocarpa*, and is evidently the same one cited by Nuttall under *Campylocera leptocarpa* var. *glabella*. In Nuttall's original description of *C. leptocarpa* he cited neither any definite collection nor any locality except "Arkansas" for the species proper, while under the variety he cited not only the locality, Fort Gibson, but also the collector and the manuscript name proposed by him. Engelmann's collection is therefore certainly the type of var. *glabella;* at least one large plant of the 5 on the sheet fits the description ("stem and leaves nearly smooth"). It is of course possible that Nuttall had no collection of his own to refer to *C. leptocarpa;* if so the same Engelmann collection may be regarded as the type of his species, for at least two of the plants on the sheet are noticeably shaggy, fitting his description ("stem hirsute at the angles, leaves ciliate").

The type of *Specularia Linsecomia* Buckley, an over-mature fruiting specimen, is likewise at the Academy of Natural Sciences of Philadelphia, mounted on the same sheet with the type of *Campylocera leptocarpa* var. *glabella*. Buckley's collection, according to the label, was made in June, 1861 at Brady's Creek north of Fort Mason, Texas.

The identity of *Triodanis scabra* Raf. cannot be determined with certainty, but on the basis of his description it seems most probable that it is identical with *Campylocera leptocarpa* Nutt. Rafinesque's description was as follows:

"905. *Triodanis scabra* Raf. erect rough humble, leaves sessile oblong acute subentire, upper linear; capsules axillary solitary terete curved crowned by 3 subulate teeth—annual, 2 to 4 inches high, seldom with one or two branches, lower leaves broader subcrenate. Found by me 1823 in the glades near the mouth of the Tennessee R. and by Nuttal at Cedar prairies in Arkanzas; but out of 7 specimens not one is in bloom, all are in seeds, probably very early vernal."

The plant found by Rafinesque near the mouth of the Tennessee River hardly can have been the same as Nuttall's *Campylocera leptocarpa*, but on the basis of a collection sent by Nuttall to Schweinitz and now in the herbarium at Philadelphia, I suppose Rafinesque's description to have been drawn up mostly, if not entirely, from Nuttall's Arkansas material, which is *leptocarpa*. Nuttall's personal material of this collection seems not be at Philadelphia and may be at the British Museum; if it can be located, and agrees with the description of *Triodanis scabra*, I think there can be no doubt that Rafinesque had it in mind (even if not before him!) when writing the description. Schweinitz' part of Nuttall's collection is labelled "Red River Nuttall," and bears Nuttall's own ticket with the locality "Ark" and the name "Specularia *scaber" in Nuttall's hand crossed out and another unpublished name substituted for it. The collection consists of a portion of a plant with open flowers, and 6 or 7 plants 7–12 cm. high, in fruit, with cleistogamous flowers only; 1 plant is branched slightly. If

Nuttall divided his collection into approximately equal parts, as he may well have done, then Rafinesque's description may well apply to the part kept at Philadelphia, for the reader may note how well it applies at critical points to the plants kept by Schweinitz: upper leaves linear, capsules terete curved crowned by 3 subulate teeth, plants 2–4 inches high, seldom with 1 or 2 branches, out of 7 specimens not one is in bloom, all are in seeds. Even the name, *scabra*, seems to have been taken from Nuttall.

This species well illustrates a point made earlier in this paper (Recommendation 3, p. 15). The mature capsules of the cleistogamous flowers, as first pointed out by Nuttall, are for the most part without definite valves, and are in addition unilocular, with parietal placentation, opening by longitudinal slits in the manner of *Downingia*, of the LOBELIOIDEAE. Nuttall considered this character of generic value, since no comparable condition is found elsewhere in *Specularia* (including *Triodanis*). Certainly the character is unique, but all other characters of *T. leptocarpa* are so unquestionably those typical of *Triodanis*, that it seems clear that *T. leptocarpa* is biologically a member of the genus but with one strikingly anomalous feature. It is probable that suppression of parts in the cleistogamous flowers has gone further in this species than in others, with accompanying reduction not only in the corolla and androecium, but also in the ovary and accessory parts.

DOUBTFUL SPECIES

Campanula angulata Raf., Fl. Ludov. 55. 1817. This is evidently either *Triodanis biflora* or *T. perfoliata*, but it is impossible from Rafinesque's description to decide which.

Specularia Juliani Batt. in Batt. & Trab., Fl. Alger. Tunis. 222. 1902; *Legousia Juliani* Briq., Candollea 4: 332. 1931. This is known only from the type collection, which is said to differ from *Specularia* (*Triodanis*) *falcata* chiefly in having the flowers long-pedunculate. No mention is made, either in Battandier's original description or in Briquet's fuller one, of cleistogamous flowers. The plant may be an aberrant form of *T. falcata*, as similarly pedunculate forms of normally sessile-flowered species are found occasionally both in *Triodanis* and in *Campanula*.

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Division of Plant Exploration and Introduction
U. S. Department of Agriculture
Plant Industry Station, Beltsville, Maryland

NEW PHANEROGAMS FROM TEXAS, MEXICO AND CENTRAL AMERICA

CYRUS LONGWORTH LUNDELL

The wartime search for new sources of plant products to substitute for materials formerly obtained from Asiatic and other areas no longer accessible has brought about a long overdue examination of the plant resources of the Western Hemisphere. In spite of the accelerated program of exploration, only the surface has been scratched. One of the most fertile fields open to scientists is the study of our rich native flora with a view to discovering new plant products for industrial and other uses.

In cooperation with the Foreign Economic Administration of the U. S. Government in its search for new sources of rotenone in Mexico and Central America, studies of *Lonchocarpus* and related genera have been undertaken. In this paper, three new species of *Lonchocarpus* are described. Obviously the genus has been neglected by field botanists, for at least a third of the collections received from Mexico and Central America represent rare or unrecognized species. Whenever a genus assumes economic importance, these same deficiencies in exploration become apparent, a clear indication of our imperfect knowledge of the American flora.

In continuation of taxonomic studies, seven other new species are proposed in the genera *Cryosophila, Abronia, Bernardia, Zuelania, Parathesis, Brazoria* and *Scutellaria*. *Hypericum aphyllum* Lundell is transferred to the genus *Sarothra*.

Cryosophila bifurcata Lundell, sp. nov.—Arbor gracilis, caudice ca. 10 cm. diam., spinis rhizoideis pungentibus armato. Folia petiolata; ligula crassa triangula; lamina 80 cm. longa, segmentis ad 3.5 cm. latis, apice breviter bifidis, subfalcatis, subtus argenteo-pubescentibus. Inflorescentia laxe ramosa. Flores glabri, ca. 3 mm. longi. Calycis segmenta carnosa, basi connata, petalis vix aequilonga. Petala imbricata, libera.

Trunk slender, 10 cm. in diameter, about 8 m. high, armed with spines. Leaves palmate, the petioles slender; ligule produced, triangular; blades up to 80 cm. long, multicostate, the segments parted to or below the middle, up to 3.5 cm. wide, tapering to a bifurcate apex, margin entire, midrib strong and paralleled by numerous fine veins, silvery-sericeous on the undersurface, the hairs closely appressed. Inflorescence about 60 cm. long, downward-curved, sheaths white tomentose at first, 15–23 cm. long; rachis stout, tomentose at first, side branches up to 12 cm. long, bearing the floriferous branches 3–6 cm. long, the flowers sessile, dense. Flowers at anthesis about 3 mm. long, ellipsoid or nearly globular, bearing 6 deflexed anthers at apex. Perianth of 6 parts in two series, the calyx lobes

connate at base with conspicuous obtuse sinuses between them, petals equaling calyx lobes, not connate at base, imbricate. Filaments connate. Ovaries 3, each with long exserted style recurved at apex. Immature fruits depressed-globose.

BRITISH HONDURAS: Toledo District, Punta Gorda-San Antonio Road, near Jacinto Creek, in high ridge, November 14, 1944, *Percy H. Gentle 4972* (type in the herbarium of Southern Methodist University), a tall palm about 25 feet high and 4 inches in diameter, trunk covered with spines; San Antonio, Moffredge Creek, in wild coffee ridge, December 9, 1944, *Gentle 5063;* vernacular name, "give-and-take."

The leaf segments with bifurcate apex suggest an affinity to *Cryosophila Cookii* Bartlett, but the inflorescence of *C. bifurcata* is altogether different, being paniculiform. In *C. Cookii* the inflorescence consists of short simple branchlets fastigiate in a densely crowded interrupted spiral.

A. bifurcata is near *C. Warscewiczii* as interpreted by Bailey in Gentes Herbarum 3: 109–112 (1933). The narrower leaf segments, flowers only 3 mm. long at anthesis, and imbricate petals free to base are differences by which *C. bifurcata* may be recognized. The very immature fruits from the British Honduran tree are depressed-globose, while fruits of *C. Warscewiczii* are oblong-pyriform. Bartlett in Carnegie Inst. Wash. Publ. 461: 39 (1935) described *C. Warscewiczii* as having leaves with the segments obliquely and coarsely cross-veined, a condition not evident in *C. bifurcata.*

Abronia Ameliae Lundell, sp. nov.—Herba, ad 60 cm. alta, glanduloso-villosa. Folia petiolata, petiolo 1–8.5 cm. longo, lamina ovata, elliptica vel rotundata, 3–8 cm. longa, 2–6 cm. lata, apice rotundata, basi subcordata vel subtruncata, margine sinuata, viscida. Bracteae 5–7, ad 16 mm. longae, 10 mm. latae. Flores 18–25 mm. longi, glanduloso-villosi. Fructus turbinatus, 5-alatus, 7–9 mm. longus, 3–4.5 mm. latus.

Coarse spreading perennial herb up to 60 cm. high, viscid throughout, the stems thick, villous, the hairs variable in length and gland-tipped. Leaves petiolate, the petioles 1–8.5 cm. long, the lower often exceeding the blades; leaf blades fleshy, drying chartaceous and brittle, concolor, ovate, elliptic, suborbicular or depressed-orbicular, 3–8 cm. long, 2–6 cm. wide, apex rounded, base subcordate or subtruncate and decurrent, margin conspicuously sinuate, rather sparsely viscid pubescent on both surfaces with short hairs, costa and veins nearly plane, the primary lateral veins usually 3 on each side. Peduncles rather slender, viscid-puberulent, 2.5–12 cm. long. Bracts 5–7, pale greenish to orchid, thin, oblong, elliptic or obovate, 10–16 mm. long, 5–10 mm. wide, apex broadly rounded and acutish, viscid-villous externally. Flowers numerous, forming head 5 cm. in diameter. Perianth orchid (tube and limb), 18–25 mm. long, viscid-villous, the tube slender, the limb 10 mm. wide. Stamens 5, included. Fruits narrowly turbinate, 7–9 mm. long, 3–4.5 mm. wide at apex, 5-winged, not narrowed at apex, attenuate to the base, apex rounded or truncate, reticulate-veined, glabrous or with a few scattered hairs at apex only. Seeds oblanceolate-oblong, about 2.5 mm. long.

TEXAS: Brooks County, north of Encino, in sandy live oak belt, May 10, 1940, *C. L. Lundell & Amelia A. Lundell 8832;* 14 miles south of Falfurrias, in sandy live oak belt, March 19, 1942, *Lundell & Lundell 10816* (type in the herbarium of Southern Methodist University); north of Encino, along sandy roadside, April 9, 1944, *Lundell & Lundell 12807.*

Although long confused with *A. fragrans* Nutt., to which it has close affinity, *A. Ameliae* differs in its glabrous narrowly turbinate fruits widest at the rounded apex, orchid colored perianth, and bracts rounded at apex. The fruits of *A. fragrans* are short-villous or puberulent, usually biturbinate, and narrowed at apex.

This fine plant is worthy of widespread cultivation for ornamental purposes. In Brooks County it is planted in gardens.

Lonchocarpus belizensis Lundell, sp. nov.—Arbor, 15 cm. diam.; ramulis striatis, minute subadpresse puberulis. Folia 5–9-foliolata. Foliola membranacea, oblanceolato-oblonga vel anguste oblongo-elliptica, 4–9.5 cm. longa, 1.5–3.3 cm. lata, apice acuminata, basi rotundata, supra minute subadpresse puberula, subtus subglauca, strigillosa. Paniculae terminales. Pedicelli ad 2 mm. longi. Calyx cupulatus, 3 mm. longus, 5-dentatus. Petala atro-rubra. Ovarium strigillosum, 4-ovulatum.

Tree, 15 cm. in diameter, twigs striate, pubescent with minute subappressed reddish-brown hairs. Leaves 5–9-foliolate, the rachis subterete, up to 7 cm. long, pubescent with minute appressed golden-brown hairs. Stipules deciduous early. Leaflets membranaceous; petiolules pubescent, 3–4 mm. long; blades oblanceolate-oblong or narrowly oblong-elliptic, 4–9.5 cm. long, 1.5–3.3 cm. wide, apex short acuminate, base rounded, the sides subequal, paler beneath, the upper surface pubescent with minute subappressed golden-brown hairs, the undersurface subglaucous, strigillose, primary veins 7–9 on each side, plane on upper surface, prominent on undersurface. Racemes forming a large open terminal panicle, the lower ones axillary, up to 18 cm. long, pubescent with minute subappressed golden-brown hairs. Peduncles pubescent, 2 4-flowered, sometimes branched, 1.5–3 mm. long. Pedicels up to 2 mm. long. Calyx pubescent with minute appressed golden-brown hairs, cupulate, 3 mm. long, 5-dentate. Petals dark red; standard densely strigillose, suborbicular, the blade 9.5 mm. wide, 10 mm. long, base subcordate, the claw 1.5 mm. long; wings glabrous, the blade rounded-auriculate at base, 9 mm. long, 3 mm. wide, the claw 2 mm. long; carinal petals cohering above middle, ciliate at base. Vexillar stamen free at base. Ovary silvery-strigillose, 4-ovulate; style arcuate, hirsute.

BRITISH HONDURAS: Toledo District, upper reach of Golden Stream in cohune ridge, May 11, 1944, *Percy H. Gentle 4600* (type in the herbarium of Southern Methodist University), tree, 6 inches in diameter, flowers dark red.

The species is allied to *L. latifolius* (Willd.) H.B.K.

Lonchocarpus cruentus Lundell, sp. nov.—Arbor, 10–12 m. alta, 28 cm. diam.; ramulis parce strigillosis. Folia 9–13-foliolata. Foliola chartacea,

oblonga, oblongo-elliptica vel oblanceolata, 3–7.5 cm. longa, 1.6–3 cm. lata, apice abrupte acuminata, basi acutiuscula, subtus parce strigillosa. Inflorescentiae racemosae, axillares. Pedicelli 1–1.5 mm. longi. Calyx strigosus, cupulatus, 3 mm. longus. Petala atro-purpurea. Ovarium sericeum, 5–6-ovulatum.

Tree, 10–12 m. tall, 28 cm. diam., branches dark brown, conspicuously lenticellate, sparsely strigillose with short brown hairs. Leaves 9–13-foliolate, the rachis strigillose, up to 9 cm. long, canaliculate. Stipules deciduous early. Leaflets chartaceous; petiolules strigillose, 3.5–4.5 mm. long; blades oblong, oblong-elliptic or oblanceolate, 3–7.5 cm. long, 1.6–3 cm. wide, apex abruptly acuminate, the acumen obtusish, base acutish, persistently hirtellous along the veins on upper surface, the hairs subappressed except along the costa, entire undersurface sparsely strigillose, primary veins 7–11 on each side, slightly impressed above, conspicuous on undersurface. Racemes solitary in the axils of the upper leaves, stout, 5.5–11.5 cm. long, pubescent with short subappressed ferruginous hairs. Peduncles and pedicels ferruginous-pubescent, the peduncles solitary, 2-flowered, 2–2.5 mm. long, the pedicels 1–1.5 mm. long. Calyx strigose with brownish hairs, cupulate, 3 mm. long, the margin subentire. Petals dark reddish-purple; standard sericeous, suborbicular, biauriculate and callous at base, emarginate at apex, the claw about 2.3 mm. long, the blade 10–11 mm. long, 12–13 mm. wide; wings silky-pubescent without, auriculate at base, the claw about 4 mm. long, the blade about 9 mm. long, 4.3 mm. wide; carinal petals rounded at base, silky-pubescent. Vexillar stamen free at base. Ovary sericeous, 5–6-ovulate; style arcuate, hairy at base only.

MEXICO: TABASCO, southeast of Macuspana, between Macuspana and Cerro del Tortugero, September 30, 1944, *C. L. Gilly, Sr. & Efraim Hernandez Xolocotzi 411* (type in the herbarium of Southern Methodist University); vernacular name, "palo de sangre."

The collectors state that the bark yields a reddish fluid when cut, and that this fluid coagulates into gummy resin which becomes glossy hard within a few hours. In the absence of fruits, the relationship of the species is doubtful, but it appears to have affinity to *L. sericeus* (Poir.) H.B.K. The latter has leaves with veins strongly impressed on the upper surface.

Lonchocarpus Gillyi Lundell, sp. nov.—Arbor, 4–5 m. alta, 20–25 cm. diam.; ramulis striatis. Folia 8–10-foliolata. Stipulae 5–8 mm. longae. Foliola subcoriacea, oblonga vel oblanceolata, 1.8–4 cm. longa, 0.6–1.4 cm. lata, apice rotundata, basi obtusa, costa et nervis impressis. Inflorescentiae racemosae, axillares. Pedicelli fructiferi 2–3 mm. longi. Calyx campanulatus, ca. 2.5 mm. longus, dentatus. Legumen 1–8-spermum.

Tree 4–5 m. tall, 20–25 cm. in diameter; twigs rather stout, striate, sparsely pubescent with spreading hairs. Leaves 8–10-foliolate, the rachis pubescent with brown spreading hairs, the rachis and petiole together 8–11 cm. long. Stipules attenuate, 5–8 mm. long. Leaflets firm, subcoriaceous; petiolules pubescent, about 2 mm. long; blades of lateral leaflets

oblong, the terminal oblanceolate, 1.8–4 cm. long, 0.6–1.4 cm. wide, apex rounded or inconspicuously emarginate, base obtuse, the sides inequilateral, pubescent on undersurface with loose spreading reddish-brown hairs, the hairs fewer and shorter on upper surface, lateral veins 9–12 on each side, not strongly ascending, impressed on upper surface, conspicuous on lower surface, reticulate. Racemes axillary, borne on older wood, 3–9 cm. long, rather densely pubescent with shaggy reddish-brown hairs. Pedicels of fruits 2–3 mm. long. Persistent calyx campanulate, about 2.5 mm. long, toothed, densely strigose with reddish-brown hairs. Legume thin, elongate, narrowed to base, pubescent with appressed reddish-brown hairs, 1–8-seeded, the immature legumes up to 12 cm. long, 1.8 cm. wide.

MEXICO: CHIAPAS, hills south of Salto de Agua, about 2 kilometers from Salto de Agua on trail to Yajalon, October 4, 1944, *C. L. Gilly, Sr. & Efraim Hernandez Xolocotzi 430* (type in the herbarium of Southern Methodist University); vernacular name, "biche rayo."

Although closely resembling *L. apricus* Lundell, it is separable at once from that species by its smaller leaves and spreading reddish-brown pubescence. The affinity of *L. Gillyi* to *L. rugosus* Benth. is evident, but the latter has larger leaves usually elliptic-oblong rather than strictly oblong. In the material of *L. Gillyi* at hand, the racemes are borne on old wood, a noteworthy characteristic.

Bernardia aurantiaca Lundell, sp. nov.—Arbor parva, 10 m. alta, ramis ramulisque parce stellato-puberulis. Folia petiolata, petiolis ad 3.5 cm. longis, stellato-puberulis; lamina lanceolata, 4–12 cm. longa, 1–4 cm. lata, apice acuminata, basi obtusa vel acutiuscula, crenulato-serrulata, utrinque parce stellato-puberula. Flores dioeci. Inflorescentiae ♂ racemosae, ad 14 cm. longae, stellato-puberulae; bracteis late cordato-ovatis, ca. 2 mm. longis, 17–20-floris; pedicellis 2–4 mm. longis. Sepala 1.2–1.5 mm. longa. Stamina 10 vel 11.

A slender tree, 10 m. high, 10 cm. in diameter, the cambium bright orange; branchlets and twigs obscurely angled, rather sparsely puberulent with stellate hairs. Petioles slender, up to 3.5 cm. long, stellate-puberulent. Leaf blades slightly paler beneath, lanceolate, 4–12 cm. long, 1–4 cm. wide, apex acuminate, base narrowed, obtuse or acutish, margin remotely crenulate-serrulate, sparsely stellate-puberulent on both surfaces, the indument persistent only on the veins at maturity, costa and primary veins conspicuous on lower surface, the primary veins 5 or 6 on each side. Staminate inflorescence slender, unbranched, up to 14 cm. long, stellate-puberulent; bracts broadly cordate-ovate, about 2 mm. long, obtusish, puberulent; flowers 17–20 in basal bracts, pedicels slender, 2–4 mm. long, jointed near or at the base. Sepals 3, elliptic, 1.2–1.5 mm. long, acute, with a few hairs on the outer surface. Stamens 10 or 11, radiating; filaments about 1 mm. long, glabrous. Pistillate flowers and fruits unknown.

BRITISH HONDURAS: El Cayo District, Chalillo Crossing, in advanced forest on hillside, July 15, 1936, *C. L. Lundell 6509* (type in the herbarium of Southern Methodist University).

This collection, originally distributed as a new species of *Acalypha* by P. C. Standley, was referred by the writer to *B. interrupta* (Schl.) Muell. Arg., Contrib. Univ. Mich. Herb. 4: 12 (1940). Subsequent field studies in 1943 of *B. interrupta* in Hidalgo and San Luis Potosí have convinced the writer that the British Honduran tree should be segregated as a distinct species. *B. aurantiaca*, notable for its orange colored cambium, has smaller acuminate leaves, and smaller flowers twice as numerous in each bract. The indument of *B. interrupta* is distinctly coarser.

Sarothra aphylla (Lundell) Lundell, comb. nov. *Hypericum aphyllum* Lundell, Am. Midl. Nat. 29: 477. 1943.

Zuelania belizensis Lundell, sp. nov.—Arbor, ramulis glabris. Folia glabra, petiolata, petiolis 0.9–2 cm. longis; lamina subchartacea, oblanceolata, oblongo-oblanceolata vel oblongo-elliptica, 9–25 cm. longa, 4–9 cm. lata, apice acuminata, basi rotundata. Inflorescentiae terminales, multiflorae, pedunculatae, ad 3 cm. longae. Pedicelli glabri, ad 1.5 cm. longi. Calyx 5–6 mm. longus, lobis ciliatis. Stamina 14, filamentis et antheris pubescentibus.

A small tree or woody vine (?); twigs elongate, glabrous, rather stout. Leaves glabrous, large; petioles canaliculate, 0.9–2 cm. long; leaf blades subchartaceous, oblanceolate, oblong-oblanceolate or oblong-elliptic, 9–25 cm. long, 4–9 cm. wide, apex abruptly acuminate, base rounded, the sides unequal or subequal, glabrous on both surfaces, often drying reddish, shining above, pellucid-punctate, margin inconspicuously and remotely serrulate-crenulate, reticulate-veined, costa impressed above, prominent on undersurface, the primary veins 8–12 on each side, slender but conspicuous. Inflorescences borne at the apical nodes, many-flowered, pedunculate, up to 3 cm. long, conspicuously bracteate; peduncles short, up to 6 mm. long, glabrous; bracts and bractlets ciliate. Pedicels slender, glabrous, up to 1.5 cm. long. Calyx 5–6 mm. long, the 5 lobes ciliate, elliptic, unequal. Stamens 14, filaments and anthers pubescent; appendages of the disk alternating with the stamens, a third shorter than the filaments, pubescent. Ovary pubescent; stigma capitate. Fruits fleshy, about 3 cm. in diameter.

BRITISH HONDURAS: Toledo District, Bolo Camp, upper reach of Golden Stream, in high ridge, April 15, 1944, *Percy H. Gentle 4537* (type in the herbarium of Southern Methodist University), woody vine, flowers whitish; Rio Grande, in wild coffee ridge, July 7, 1944, *Gentle 4696*, tree, 6 in. diam., bark grayish, wood creamish.

The common species of Mexico and Central America, *Z. Guidonia* (Swartz) Britt. & Millsp., has altogether different leaves densely soft-pubescent on the undersurface.

Parathesis membranacea Lundell, sp. nov.—Arbor parva, ramis ramulisque brunneo-lepidotis. Folia petiolata, petiolis 1–2 cm. longis, lepidotis; lamina membranacea, elliptica vel obovato-elliptica, 8.5–15 cm. longa, 4.5–7.5 cm. lata, apice abrupte acuminata, supra glabra, subtus stellato-lepidota, crenulato-dentata. Inflorescentiae terminales, anguste paniculatae, brunneo-lepidotae, 8–10 cm. longae. Flores corymbosi, brun-

neo-lepidoti. Pedicelli ad 4 mm. longi. Sepala 1.3–1.5 mm. longa, acuta. Petala anguste lanceolata, ca. 5.5 mm. longa. Antherae 2.2 mm. longae, punctatae.

A small tree; branches rather stout, persistently lepidote; twigs brown lepidote. Petioles 1–2 cm. long, canaliculate, lepidote. Leaf blades membranaceous, elliptic or obovate-elliptic, 8.5–15 cm. long, 4.5–7.5 cm. wide, apex abruptly acuminate, base decurrent on the petiole, stellate-lepidote on the undersurface at first, essentially glabrous with age, glabrous on upper surface, black punctate, finely reticulate-veined, primary veins 12–15 on each side, conspicuous on undersurface, plane or slightly impressed on upper surface, margin conspicuously crenulate-dentate almost to base. Inflorescence leafy, terminal, narrowly paniculate, brown lepidote, 8–10 cm. long. Flowers corymbose, brown lepidote, borne on pedicels up to 4 mm. long; buds 4 mm. long at anthesis. Sepals narrowly triangular, 1.3–1.5 mm. long, acute. Petals about 5.5 mm. long, coherent at base only, narrowly lanceolate, attenuate to the apex, punctate. Filaments stout, about 1.3 mm. long. Anthers conspicuously black punctate, ovate-lanceolate, 2.2 mm. long, apiculate. Ovary with a few hairs at apex, glabrous otherwise. Style 3.5 mm. long, glabrous.

BRITISH HONDURAS: Tea Kettle, May 12, 1931, *H. H. Bartlett 13140* (type in the herbarium of Southern Methodist University), a small tree, flowers dull pink.

P. membranacea is separable from *P. serrulata* (Swartz) Mez, to which it is closely allied, by the broadly elliptic or obovate-elliptic membranaceous leaves with conspicuously dentate margin. Further, *P. membranacea* has smaller inflorescences and flowers. In superficial aspects, the species resembles *P. pleurobotryosa* Donn. Sm.

Brazoria arenaria Lundell, sp. nov.—Herba, 40 cm. alta, ramulis pubescentibus. Folia membranacea, oblongo-elliptica, oblanceolato-elliptica, vel lineari-oblonga, usque ad 12 cm. longa, 3.5 cm. lata, apice rotundata, basi attenuata, denticulata. Inflorescentiae racemosae, ad 30 cm. longae. Calyx campanulatus, 5.5 mm. longus. Corolla 1.3–1.8 cm. longa.

Annual, up to 40 cm. high, branching at the base, stems erect or ascending, pubescent with short hairs. Leaves membranaceous, the basal petiolate, oblong-elliptic or oblanceolate-elliptic, up to 12 cm. long, 3.5 cm. wide, rounded at apex, attenuate at base, denticulate, undersurface glabrous, upper surface with a few short hairs along midrib at base of blade, the petiole often subequaling the blade; cauline leaves few, remote, linear-oblong, oblanceolate-oblong or obovate-oblong, sessile, reduced, those below inflorescence bract-like, often partly clasping, denticulate. Racemes up to 30 cm. long, interrupted, the flowers rather remote, pubescent, the hairs short with glandular ones intermixed. Bracts broadly elliptic or ovate-elliptic, about 3.5–5 mm. long, acute. Calyx campanulate, 5.5 mm. long, becoming 9 mm. long in fruit, the lips subequal; tube pubescent with short hairs, some glandular, not bearded, the upper lip of 3 broad rounded lobes, the lateral ones apiculate, the middle one rounded, the lower lip slightly

longer, shallowly 2-lobed, the lobes sharply dentate with 3–5 short subulate teeth. Corolla lavender with maculate throat, sparsely puberulent along back, 1.3–1.8 cm. long, tube dilated upward, the upper lip with 2 oblong subentire (not toothed) lobes, the lower lip with 3 smaller lobes which are emarginate at apex. Nutlets pubescent, 2 mm. in diameter.

TEXAS: Brooks County, off U. S. highway 281, south of Encino, on sandy plains, April 6, 1944, *C. L. Lundell & Amelia A. Lundell 12766* (type in the herbarium of Southern Methodist University).

In characteristics of the calyx and corolla, *B. arenaria* approaches *B. truncata* (Benth.) Engelm. & Gray. The calyx of *B. arenaria* differs in not having a viscid-villous beard, and in having unequal lips with the middle lobe of the upper lip rounded, not apiculate. The upper lip of the corolla in *B. arenaria* has subentire lobes, while the lobes in *B. truncata* are distinctly toothed.

In habit there is a broad divergence between the two species. In *B. arenaria* the cauline leaves are reduced and bract-like below the inflorescence; in the other species the cauline leaves are large and well developed to the base of the raceme. In *B. truncata* the racemes are short and densely flowered while in *B. arenaria* they are interrupted their entire length.

Scutellaria petenensis Lundell, sp. nov.—Herba, 20–40 cm. alta, ramulis gracilibus, pubescentibus. Folia petiolata, petiolis ad 5 mm. longis; lamina late ovata vel rhomboideo-ovata, parva, raro ad 1.7 cm. longa, 1.6 cm. lata, apice rotundata, basi acuta, crenata. Flores axillares vel breviter racemosi. Pedicelli ca. 4 mm. longi. Calyx pubescentibus, 2–3 mm. longus. Corolla 10–11 mm. longa.

A low spreading herb, 20–40 cm. high, the stems slender and weak, pubescent with short recurved hairs. Petioles short, slender, up to 5 mm. long, pubescent. Leaf blades broadly ovate or rhomboid-ovate, usually very small, sometimes up to 1.7 cm. long, 1.6 cm. wide, apex rounded, base abruptly acute, margin conspicuously crenate with 3 or 4 teeth on each side, basal third entire, sparsely hairy on both surfaces, the hairs coarser and denser along the veins on the undersurface. Flowers axillary, or borne in short racemes about 2 cm. long. Pedicels slender, pubescent, about 4 mm. long, bearing two filiform bracts near the base. Calyx pubescent, 2–3 mm. long at anthesis. 3.5–4 mm. long at maturity. Corolla blue, the tube and galea 10–11 mm. long. Lower stamens seated about 5 mm. above base of tube.

GUATEMALA: Department of Petén, Chimah Savanna near La Libertad, in open grassland, June 4, 1933, *C. L. Lundell 3614* (type in the herbarium of Southern Methodist University), flowers blue.

This herb has the habit suggesting *S. havanensis* Jacq. and *S. Gaumeri* Leonard. In its smaller flowers with galea and tube of corolla 10 to 11 mm. long, and lower stamens seated only 5 mm. above the base of the tube, it differs from both of these species. The relationships of *S. petenensis* have been pointed out by Epling in Carnegie Inst. Wash. Publ. 522: 230 (1940), and in Univ. Calif. Publ. Bot. 20: 109 (1942).

NOTES

Charles Wright, immortalized in the plant names of the state, was the foremost botanical explorer of early Texas. His portrait of unknown date, reproduced as the frontispiece, was supplied by the Gray Herbarium of Harvard University through the courtesy of Mr. C. A. Weatherby.

NEWS

On February 1, 1945, Dr. Lloyd H. Shinners was appointed Research Fellow in the Institute of Technology and Plant Industry to undertake studies upon the COMPOSITAE of Texas. Dr. Shinners received his Ph. D. degree from the University of Wisconsin under Dr. N. C. Fassett in 1943, his thesis being "The Grasses of Wisconsin." In 1943–1944 he was Assitant in the Department of Soils of the University of Wisconsin, and later Botanist of the Whitnall Arboretum in Milwaukee. Since 1944 he has been a Research Associate in Botany of the Milwaukee Public Museum. In addition to his work upon the grasses of Wisconsin, Dr. Shinners has published various papers on the genera *Aster* and *Liatris* in North America.

Dr. Rogers McVaugh of the Division of Plant Exploration and Introduction of the U. S. Department of Agriculture is spending three months, May through July, in Texas carrying out field studies upon the ROSACEAE of the state. The project is sponsored jointly by the Institute of Technology and Plant Industry and the U. S. Department of Agriculture.

Dr. C. H. Muller, formerly Associate Botanist of the Bureau of Plant Industry of the U. S. Department of Agriculture, and recently engaged in wartime research upon guayule under Dr. A. C. Hildreth, has been appointed Research Fellow in the Institute of Technology and Plant Industry for three months, June through August, 1945. Dr. Muller has resumed his field work upon the oaks of Texas, and in addition is carrying out ecological studies on the vegetation.

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WRIGHTIA

A BOTANICAL JOURNAL

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WRIGHTIA

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REVISION OF THE GENUS CHAETOPAPPA DC.[1]

LLOYD H. SHINNERS

INTRODUCTION

The taxonomy of the Compositae has suffered greatly from excessive reliance on the nature of the pappus, or its presence or absence, as a character of generic value. On this sole basis, species obviously very similar, and differing in no other significant respect, have been regarded as constituting separate genera. *Serinia* has been thus arbitrarily separated from *Krigia*, *Brachychaeta* from *Solidago*, *Amphiachyris* from *Gutierrezia*, *Eremiastrum* from *Monoptilon*, *Achaetogeron* from *Erigeron*. Conversely, some species have been detached from their near congeners and placed with species to which they have much less resemblance, on little more grounds than similarity of pappus. *Aster* has been made to include *Leucelene*, which in structure of florets and phyllaries (involucral bracts), and vegetative parts, is much closer to *Chaetopappa*, and *Brachyactis*, which is nearer to *Conyza; Bellis* has been made to include *Astranthium*, which is closer to *Dichaetophora; Solidago* to include *Euthamia*, which is nearer to *Gutierrezia*.

The previously recognized species here included in *Chaetopappa* have been placed not only in separate genera, but in separate subtribes, largely on the basis of presence or absence of pappus. In the type species of *Chaetopappa* (ASTEREAE-ASTERINAE), *C. asteroides* (Nutt.) DC., the pappus normally consists of five well-developed hyaline scales and as many bristle-like awns. But var. *imberbis* A. Gray was described as lacking the awns. In addition, the scales vary greatly in length, being sometimes hardly more than vestigial in the species proper; and the variations may be similar or may differ greatly between disk and ray florets. *Bourdonia bellidifolia* (Gray & Engelm.) Greene (*Keerlia bellidifolia* Gray & Engelm.), which in the field looks exactly like a robust form of *Chaetopappa asteroides*, was placed in another genus and subtribe (ASTEREAE-BELLIDINAE) because of the absence of a pappus. But the summit of the achene bears a thickened

[1] The five revisions which follow have benefited from the work of many more hands and minds than the author's. I am grateful to Dr. Eula Whitehouse and Mr. V. L. Cory, upon whose wide and intimate knowledge of Texas plants and Texas places I have drawn many times; to Dr. S. W. Geiser for great and constant help in matters relating to botanical collectors in the Southwest and Mexico; to Mr. H. B. Parks,

ring, and may rarely show a vestigial scaly crown. The second species of *Bourdonia*, *B. effusa* (A. Gray) Greene, regularly has a crown of very short hyaline scales, like that sometimes found in *Chaetopappa asteroides*.

The genus *Diplostelma*, differing from *Chaetopappa* chiefly in the more numerous florets and 2-nerved achenes, was described by Asa Gray with the observation that its single species, *D. bellioides*, might better be transferred to *Chaetopappa*. This was later done by him, but he adopted the name of De Candolle's *Distasis modesta*, which he mistook for the same plant. Fragmentary and immature specimens of the two are very similar in appearance, but De Candolle's plant was a closer congener of *Chaetopappa asteroides*, differing from Gray's in the less numerous florets and several-nerved achenes. De Candolle was doubtful as to the affinities of his genus *Distasis*, having been unable to determine that the anthers were not caudate. He curiously fails to compare it with his own *Chaetopappa*, though his descriptions of the two genera are remarkably similar, and give no marked differences between them.

The plants of these three groups (*Bourdonia*, *Chaetopappa*, and, by error, *Distasis*) closely resemble each other in details of floral structure, and in form and texture of phyllaries. Ignoring the fickle and wholly unreliable character of the pappus, the eight species now known fall naturally into four series on the basis of shape of involucre, number of florets, nature of the achenes, duration of plant, foliage, and habit and general appearance. These series do not correspond to any of the genera in which the species were described, being based on similarities in a number of characters instead of the single, arbitrary, inconstant one of the pappus. They are here adopted as subdivisions of a single amplified genus.

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curator, and Mrs. J. J. Taubenhaus, of the Tracy Herbarium, to Dr. B. C. Tharp, director, Dr. Fred Barkley, curator, and Mr. Barton H. Warnock, of the University of Texas Herbarium, all of whom have borne cheerfully the double imposition of demands in personal visits and in correspondence; to those in charge of the herbaria given in the list of abbreviations following, who responded readily and generously to requests for large loans, including many types and isotypes; and to the librarians of Fondren Library of Southern Methodist University, the Gray Herbarium, and the Missouri Botanical Garden, in particular to Miss Nell C. Horner and Miss E. Mepham of the last institution, for their part in furthering the large and critical portion of my work which was almost exclusively bibliographical. Especial thanks are due Dr. E. D. Merrill, of the Arnold Arboretum, who responded promptly and generously to a request for assistance with Rafinesque references by sending his personal notes, abstracts, tracings, and parts of the manuscript of his forthcoming *Index Rafinesquianus*.

The location of specimens cited in the following revisions is indicated by abbreviations of herbaria, as follows: University of California, Berkeley (C); Herbarium of I. W. Clokey, University of California, Berkeley (C-Cl); Dudley Herbarium, Stanford University (D); Gray Herbarium, Harvard University (G); University of Illinois, Urbana (Ill); Missouri Botanical Garden, St. Louis (Mo); New York Botanical Garden, New York (NY); Academy of Natural Sciences, Philadelphia (P); Rocky Mountain Herbarium, University of Wyoming (RM); Southern Methodist University, Dallas (SMU); University of Texas, Austin (T); Tracy Herbarium, Texas A. & M. College, College Station (TAM); United States National Herbarium (US); United States National Aboretum (USNA); West Virginia University, Morgantown (WV).

SYSTEMATIC TREATMENT

CHAETOPAPPA DC., Prodromus 5: 301. 1836.

Chaetophora Nutt., Journ. Phila. Acad. 7: 111. 1834. (Printed as *Chaetanthera*, corrected in erratum slip to *Chaetophora*.) Not *Chaetophora* Schrank, 1789.
Distasis DC., Prodr. 5: 279. 1836. (This genus first merged with *Chaetopappa*, under the latter name, by Gray, Proc. Amer. Acad. 16: 82. 1880.)
Diplostelma Raf., New Fl. N. A. 2: 44. 1837 (dated 1836).
Diplostelma A. Gray, Plantae Fendlerianae (Mem. Amer. Acad. n.s. 4): 72–73. 1849. (Rafinesque's name used for a professedly new genus, on the grounds that fewer synonyms would be created if it also proved to be assignable to *Chaetopappa*.)
Keerlia A. Gray, Plantae Wrightianae (Smithsonian Contr. 3): 92. 1852. Not *Keerlia* DC., Prodr. 5: 309–310. 1836. (Gray transmogrified De Candolle's genus, and after all the original species had been placed elsewhere, took it over as his own. In Plantae Lindheimerianae II (Boston Journ. Nat. Hist. 6): 221, 1850, where *Keerlia* is used essentially in its new form, it is still attributed to De Candolle.)
Bourdonia Greene, Erythea 1: 207. 1893.

COMPOSITAE, tribe ASTEREAE, subtribe ASTERINAE.

Plants annual with taproots, or perennial and either tufted from a vertically forking rootstock or caudex, or forming loose tufts from superficial slender rhizomes. Leaves alternate, simple, entire, sessile or with narrowed petiole-like bases. Inflorescence (when of more than a single head) cymose, the first head to flower terminating the main axis, the later ones (often much overtopping it) on lateral branches, solitary and terminal on the branches or branchlets. Involucre hemispherical to subcylindrical, of elliptic to linear-lanceolate, stiff, chartaceous, green (sometimes purple to red brown), scarious-margined phyllaries, appressed and imbricated in about 2–6 series, the outermost not more than half as long as the innermost, all often concave, especially in drying, and appearing broadly keeled. Receptacle flat or slightly convex, naked, roughened by the points of attachment of the achenes. Heads heterogamous, radiate, heterochromous, few to many flowered. Ray flowers uniseriate, pistillate, fertile, ligulate; the ligules obtuse, entire or minutely denticulate, 4-nerved, white to rosy, lavender, or violet blue; style branches linear, more or less flattened, obtuse or subacute. Disk flowers hermaphrodite, fertile, but the central ones often abortive; corollas yellow, tubular-funnelform, with a very short basal tube, or limb and tube scarcely differentiated, the summit regularly 5-lobed; style branches flattened, tipped with a broadly to narrowly acute, triangular appendage; anthers obtuse at base, the acute appendage at the summit somewhat thickened, at least down the center. Achenes 2-, 3-, 4-, 5-, or 10-nerved, compressed to subterete, those of disk and ray either similar or dissimilar. Pappus of 5 equal, erose, hyaline scales, free or united up to half way into a crown; or of scales (sometimes very short) and 1 or 5 alternating, longer, setiform, scabrous awns; or pappus vestigial or apparently wanting, represented by a minute erose crown or merely by

a thickened ring on the summit of the achene. Pappus of disk and ray flowers usually similar when present, but that of the ray flowers often shorter, rarely longer; in species normally having both awns and scales, the awns may be wanting in either or both types of flower.

Type species: *Chaetophora asteroides* Nutt. [= *Chaetopappa asteroides* (Nutt.) DC.]

KEY TO THE SPECIES OF CHAETOPAPPA

1. Involucres narrowly cylindrical to broadly conical in flower (broader in fruit), more or less acute at base, with 5–18 rays and 6–26 disk florets; disks 1.5–5.0 mm. across in flower (as pressed) ..... 2.

2. Involucres 5.0–6.5 mm. or more high ..... 3.

3. Stem leaves broadest near the base or nearly the same width throughout, the upper more or less clasping .... 2. *C. effusa.*

3. Stem leaves broadest near the middle or above, not at all clasping ..... 4.

4. Stem leaves broadly spatulate to elliptic, those just below the inflorescence 8–12 mm. wide, 16–25 mm. long ..... 3. *C. keerlioides.*

4. Stem leaves narrowly spatulate, those just below the inflorescence 1–6 mm. wide, 6–20 mm. long .... 4. *C. Parryi.*

2. Involucres 3.0–4.9 mm. high ..... 5.

5. Middle and upper stem leaves broadest near the base or about the same width throughout, the uppermost more or less clasping ..... 2. *C. effusa.*

5. Middle and upper stem leaves broadest above the middle, not at all clasping ..... 6.

6. Plant a low, matted, almost moss-like perennial from rather woody, much-divided rootstocks; stem leaves linear-oblanceolate, coriaceous, persistent, of nearly uniform size; species of the mountains of west Texas and New Mexico. ..... 1. *C. Hersheyi.*

6. Plant annual from a simple taproot; stem leaves spatulate to linear, the lower soon withering, the upper much smaller ..... 7.

7. Inner phyllaries glabrous and entire or with very minutely erose margins, abruptly pointed and often awn-tipped; pappus represented merely by a thickened ring or minute erose crown ... 5. *C. bellidifolia.*

7. Inner phyllaries with prominently lacerate-ciliate margins, especially near the apex, the excurrent midvein made inconspicuous by the ciliation; pappus of well developed scales in either the ray or disk florets, or both, with or without longer awns in addition ..... 8.

8. Pubescence of stem and branches loosely to closely appressed, rarely spreading, in plants of the central Texas granite area (a single exceptional collection also seen from Oklahoma); pappus various, but awns usually present in either the ray or disk florets if not both.....9.

9. Rays 5–13, disk florets 6–15; younger involucres narrowly cylindrical; middle phyllaries about 0.5–0.8 mm. wide; widespread plants of Texas and states north and east.....6a. *C. asteroides.*

9. Rays 12–18, disk florets 15–26; even the younger involucres conical; middle phyllaries about 0.7–1.0 mm. wide, plants of the lower Rio Grande Valley, Texas. .....6b. *C. asteroides* var. *grandis.*

8. Pubescence of stem and main branches rather coarse and widely spreading, that of the branchlets and peduncles spreading to appressed, the plant rather shaggy in appearance; pappus of well developed scales only, without awns in either ray or disk florets; plants of south central Texas.....6c. *C. asteroides* var. *imberbis.*

1. Involucres campanulate or hemispherical in flower, rather broad and rounded at base, with 12–28 rays and 32–106 disk florets; disk 4–12 mm. across.....10.

10. Pubescence of peduncles appressed, or long, irregularly spreading, and matted; phyllaries imbricated in about 4–6 series.....11.

11. Pubescence of peduncles appressed or closely ascending, the hairs mostly less than 1 mm. long; involucres 4.0–5.1 mm. high.....7a. *C. bellioides.*

11. Pubescence of peduncles dense, spreading, more or less matted, the hairs mostly about 1.0–1.5 mm. long; involucres 5.0–6.5 mm. high.....7b. *C. bellioides* var. *hirticaulis.*

10. Pubescence of peduncles stiffly spreading at right angles, the hairs mostly 0.5–0.75 mm. long; phyllaries imbricated in about 3–4 series.....8. *C. pulchella.*

Series 1. HERSHEYANAE. Perennes exiguae quasimuscoideae, basi sublignosae, capitulis paucifloris (disci 5–6); achaenia florum radii 2- vel 3-costata, disci 5-costata.

Very small, matted, almost moss-like perennials from more or less woody bases; heads few-flowered (disk florets 5–6); achenes of ray florets 2- or 3-nerved, those of the disk florets 5-nerved.

1. CHAETOPAPPA HERSHEYI Blake, Proc. Biol. Soc. Wash. 59: 47–48. 1946.

Tufted or matted perennial from slightly woody, vertically or obliquely much forked rootstocks. Stems up to 2 cm. long (or according to the col-

lector of the type, plants up to 1 or 2 inches, or as much as 5 cm., high), simple, flexuously ascending, sparsely pubescent with ascending or loosely appressed hispid hairs; terminated by a solitary head on a peduncle naked for 1–5 mm., or a few by a tuft of small leaves. Basal rosette-like leaf clusters (beginning of next season's stems?) with spatulate or oblanceolate, subacute, apiculate leaves 1.5–6.0 mm. long, 0.3–1.0 mm. wide. Stem leaves 4–7, linear-oblanceolate or linear, 3.0–7.5 mm. long, 0.4 1.0 mm. wide, acute and with a translucent spiny tip, coriaceous, 1-ribbed (rib almost keel-like beneath), sparsely hispid-strigose or glabrous, persistent; lower leaves with narrowed, somewhat petiole-like bases, the upper slightly smaller. Involucres 4.0 -4.6 mm. high; phyllaries lanceolate, acute or acuminate and slenderly spine-pointed, sparsely appressed pubescent on the midrib or glabrous, green or rose-purple to brownish, with white-scarious, ciliate margins, imbricated in about 4 series; middle phyllaries about 0.5–0.8 mm. wide. Receptacle flat or in age convex (but extremely small, less than half a millimeter broad, and its true form scarcely distinguishable), glabrous, the points of attachment of the achenes marked by minute knobs. Ray florets 6–10; ligules when fresh "bluish, fading to white in age," when dry reddish purple, elliptic, about 5 mm. long, 2 mm. wide; tube about 2.5 mm. long. Disk florets 5–6, corollas 3.3–4.3 mm. long, yellow. Achenes of ray florets 2- or 3-nerved, 1.3 mm. long (not fully mature), sparsely pubescent. Achenes of disk florets 5-nerved, 0.8–1.0 mm. long (not fully mature), pubescent. Pappus similar in disk and ray florets, of 5 (rarely 4 or 6) awns 3.6–4.2 mm. long, and as many very minute, ciliate or erose scales about 0.1 mm. long.

The type was collected on barren, rocky ledges in canyons of the Guadalupe Mountains, 5000 ft., in Eddy Co., New Mexico, by A. L. Hershey, no. 3532, May 23, 1944 (in herb. U. S. National Arboretum). Known only from the type and the following collections:

TEXAS: Culberson Co., McKittrick Canyon, Guadalupe Mts., *Paul C. Standley 40551* (US; collected Aug. 15–17, 1924, showing only the remnants of a few disintegrated heads); Guadalupe Mts., *V. Havard* in 1882 (G).

Series 2. EFFUSAE. Perennes serovernales, aestivales, vel autumnales longicaules, capitulis paucifloris (disci 4-16); achaenia fl. radii bi- vel tri-costata, disci bicostata compressa.

Perennials flowering in late spring, summer, or fall; stems rather tall, simple for some distance above the base; heads few-flowered (disk florets 4-16); achenes of ray florets 2- or 3-nerved, those of the disk florets 2-nerved, compressed.

2. **Chaetopappa effusa** (A. Gray) Shinners, comb. nov.

Keerlia effusa A. Gray, Plantae Lindheimerianae II (Boston Journ. Nat. Hist. 6): 222. 1850.
Bourdonia effusa (A. Gray) Greene, Erythea 1: 207. 1893.

Perennial from a somewhat woody, irregular crown. Stems one or several, 20–70 cm. tall, loosely pubescent with rather long, whitish, spread-

ing to appressed hairs, simple up to the diffusely branched inflorescence which occupies the terminal ¼–½ of the plant, with about 15–35 leaves below the inflorescence. Leaves rather coriaceous, dark olive green, sparsely strigose on both surfaces and ciliate on the margin with hispid hairs; the lowest oblong to oblong-lanceolate, with more or less narrowed bases, 1.8–5.5 cm. long, 0.5–1.3 cm. wide, the narrowed base making up ⅙–⅓ the total length; middle and upper leaves gradually and slightly reduced, lanceolate-oblong to deltoid-oblong, the upper broadest at base, sessile and more or less clasping, 1–2 cm. long, 0.5–1.0 cm. wide. Leaves of the branches abruptly much reduced to narrowly oblong or (on the branchlets and peduncles) linear-subulate bracts, the larger ones 0.6–1.5 cm. long, 0.3–0.6 cm. wide, the smaller as little as 0.3 mm. long, the width hardly measurable without a strong lens. Involucres conical or broadly cylindric, 4.0–5.2 mm. tall. Phyllaries imbricated in about 3–5 series, oval to oblong-lanceolate, mucronate or abruptly aristate-acuminate, glabrous, the broad scarious margins entire or irregularly erose; middle phyllaries 0.8–1.2 mm. wide. Ray florets 6–9, ligules elliptic-oblong, 3.0–4.5 mm. long, white. Disk florets 4–7, corollas 2.5–3.3 mm. long, yellow. Achenes of ray florets compressed, 2-ribbed, pubescent, obtusely lanceolate in outline, 2.0–2.2 mm. long. Achenes of disk florets irregularly prismatic, 3-, 4-, or 5-ribbed, pubescent on the ribs, 1.6–2.0 mm. long. Pappus a thickened ring or cup-like erose crown, similar in disk and ray florets.

Thickets and open ground, dry hillsides, chiefly in rocky limestone soil, in and near the southeastern margin of the Edwards Plateau, south central Texas; flowering from mid July to late September (a single collection dated May 29).

The type was collected in shady declivities on the banks of the upper Guadalupe River near Comanche Spring (in northern Bexar Co.), by F. Lindheimer, Fl. Tex. Exs. no. 629, "August, September," 1847 (in Gray Herb., not seen; isotypes in herb. Missouri Botanical Garden, herb. New York Botanical Garden, and U. S. National Herb.).

Some specimens examined: TEXAS: Bexar Co., Comanche Spring (? no data given, but specimens probably from type locality), *Lindheimer Exs. 933* (C, Mo, NY, T, US). Edwards Co., Leakey, *E. J. Palmer 10165* (Mo). Gillespie Co., White Oak Creek, *G. Jermy 815* (Mo, US). Kendall Co., 5 miles n.e. of Boerne, *F. W. Pennell 5483* (NY); 6 miles s. of Boerne, *H. B. Parks & V. L. Cory 20709* (TAM); Spanish Pass, *Parks & Cory 19389* (TAM); *E. J. Palmer 1083* (Mo, US). Kerr Co., Hunt, *Hunt School*, fall, 1926 (T; apparently the same, without collector, US); near Hunt, *Eula Whitehouse*, Sept. 1, 1930 (T); Ingram, *Parks 27688* (TAM), *Parks & Cory 27706* (TAM). Medina Co.?, *Amanda Evans*, May 29, 1939 (NY, T; label reads merely "Medina"); San Geronimo Creek, *J. Reverchon 1534* (Mo; location unknown, but quite probably in Medina Co.). Real Co., Thousand Springs, *Parks & Cory 19100–01* (TAM).

3. **Chaetopappa keerlioides** Shinners, sp. nov.

C. effusae et *C. Parryi* affinis. Perennis? ad 45 cm. alta; caulis ad inflorescentiam simplex, infra crebre foliosus; folia inferiora oblongo-cuneata

subpetiolata 2.5–3.5 cm. longa, 0.7–1.1 cm. lata, superiora elliptica vel elliptico-oblanceolata sessilia vel subsessilia nec amplectentia. Involucra subcylindrica ca. 5.3 mm. alta. Flores radii 5–9, ligulis oblongis ca. 3.5 mm. longis albis demum roseo-violaceis. Flores disci 12–14, corollis ca. 2.8 mm. longis. Achaenia 5-costata; pappus paleaceus, paleis hyalinis 0.4 mm. (radii) ad 0.7 mm. (disci) longis.

Perennial? up to 45 cm. tall; root unknown. Stem simple to the diffuse inflorescence which occupies about the terminal ½ or ⅓ of the plant, loosely villous with widely spreading crisped hairs, with over 50 leaves below the inflorescence, mostly crowded in the basal half of the stem proper. Leaves loosely villous over the whole undersurface and on the veins above, the lower cuneate-oblong, about 2.5–3.5 cm. long, 0.7–1.1 cm. wide, broadest near the apex, tapered to a narrow base. Middle and upper leaves elliptic or elliptic-oblanceolate, subsessile or sessile but not clasping, the uppermost 16–25 mm. long, 8–12 mm. wide. Leaves of the branches abruptly smaller, lanceolate, up to 18 mm. long, 6 mm. wide. Involucres subcylindrical, about 5.3 mm. tall. Phyllaries imbricated in about 4–6 series, lanceolate, glabrous, the scarious margins sparingly erose or erose-ciliolate toward the apex; middle phyllaries about 1.1 mm. wide. Ray florets 5–9, ligules oblong, 3.5 mm. long, white, turning rose violet in withering. Disk florets 12–14, corollas 2.8 mm. long. Achenes of ray and disk florets prismatic or compressed, 5-ribbed, glabrous. Pappus a crown of 5 partially united hyaline fimbriate scales, 0.4 mm. long in the ray florets, 0.7 mm. in the disk florets.

The type was collected in a moist wooded canyon on the eastern slope of the Sierra de San Manuel, at Rancho Agua Dulce, Municipio de Muzquiz, Coahuila, Mexico, by F. Lyle Wynd and C. H. Mueller, no. 369, June 30, 1936, in early flower (in herb. Missouri Botanical Garden; isotypes in Gray Herb., herb. University of California, herb. New York Botanical Garden, and U. S. National Herb.). Known only from the type collection.

This plant stands between *C. effusa* and *C. Parryi*. It has the large stature and diffuse inflorescence of the former, but the more numerous disk florets of the latter, while the broad but narrow-based leaves rather crowded in the lower part of the stem are intermediate between the two. It differs from both in the pubescence and shape of the leaves.

4. CHAETOPAPPA PARRYI A. Gray, Proc. Amer. Acad. 16: 82. 1880.

Distasis Parryi (A. Gray) Kuntze, Rev. Gen. Pl. 1: 334. 1891.

Perennial, forming loose tufts from superficial rhizomes or stolons (resembling those of *Antennaria plantaginifolia* and its relatives, but much smaller); rhizomes producing a few leafy rosettes (these perhaps merely an early stage in the development of flowering stems). Stems erect, 10–28 cm. tall, normally simple for 4–18 cm. above the base (the terminal ¼–⅔ of the plant with few, elongate, spreading-ascending branches), sparsely to rather densely pubescent with appressed to loose or spreading somewhat hispid hairs, with about 8–25 leaves below the inflorescence

(including the basal ones). Basal leaves crowded in a persistent rosette-like cluster, narrowly oblanceolate to broadly spatulate, 10–30 mm. long (the petiolar base 4–16 mm.), 1.5–9.0 mm. wide, apiculate, sparsely strigose and ciliate, with a single prominent vein beneath. Proper stem leaves few, like the basal ones but rather abruptly smaller, the upper gradually reduced, the middle ones about 8–20 mm. long, 1.0–3.7 mm. wide, those of the branches reduced to narrowly oblanceolate or linear bracts. Involucres conical or broadly subcylindric, 5.2–6.5 mm. high. Phyllaries imbricated in about 3–5 series, lanceolate, glabrous, rather minutely serrulate-ciliolate toward the apex; middle phyllaries 0.9–1.1 mm. wide. Ray florets 7–9, ligules oval or oblong-oval, 2.5–3.5 mm. long, pink in bud, white in flower. Disk florets 10–15, corollas about 2.5 mm. long, yellow. Achenes 2.2.–2.8 mm. long, sparingly hispidulous, gradually tapered in the basal two thirds, abruptly contracted near the summit; those of the ray florets 3-ribbed, those of the disk florets 3-, 4-, or 5-ribbed (the variations often to be found in the same head). Pappus of 5 hyaline, fimbriate-ciliate scales united up to half way into a cup-like crown 0.25–0.85 mm. long; awns absent, or one (most commonly), or five, 0.8–2.5 mm. long. Pappus similar in disk and ray florets, but that of the latter usually shorter.

The type was collected at "Mt. Carmel on the Rio Grande," by C. C. Parry, Nov. 8, 1852 (in Gray Herb.; isotype, as Mexican Boundary Survey No. 492, year omitted, in herb. New York Botanical Garden). From the letter of M. T. W. Chandler in the report of the Mexican Boundary Survey, dated at Ft. Duncan, Dec. 1, 1852, it appears that the type locality was in extreme northwestern Coahuila, in the Sierra del Carmen, opposite the Chisos Mountains of Brewster Co., Texas, and within a few miles of the Rio Grande. As yet the plant is known only from northern Mexico.

Additional specimens examined: COAHUILA: Municipio de Cuatro Cienegas, Sierra de la Madera, Cañon del Pajarito, *C. H. Muller 3182* (SMU). Municipio de Villa Acuña, Sierra del Carmen, Cañon de Sentenela on Hacienda de Piedra Blanca, *Wynd & Mueller 531* (G, Mo, NY, US), *537* (US). NUEVO LEON: Sierra Madre Oriental, San Francisco Cañon, 15 miles s.w. of Pueblo Galeana, *C. H. Mueller & M. T. Mueller 269* (G, T). TAMAULIPAS: 4 km. w. of Miquihuana, lat. 23°42′ N. long. 99°45′ W., *L. R. Stanford, K. L. Retherford, & R. D. Northcraft 604* (G, Mo, NY).

Series 3. ASTEROIDEAE. Annuae vernales humiles ramosissimae capitulis paucifloris (disci 6–26); achaenia fl. radii et disci subcompressa vel subteretia quinque- vel decemcostata.

Low, spring-flowering, much branched annuals; heads few-flowered (disk florets 6–26); achenes of ray and disk slightly compressed to nearly terete, 5- or 10-ribbed.

5. **Chaetopappa bellidifolia** (Gray & Engelm.) Shinners, comb. nov.

Keerlia bellidifolia Gray & Engelm. ex A. Gray, Proc. Amer. Acad. 1: 47. 1846 (dated 1848). Republished in Pl. Lindh. II (Bost. Journ. Nat. Hist. 6): 220–221. 1850.

Bourdonia bellidifolia (Gray & Engelm.) Greene, Erythea 1: 207. 1893.

Annual from a taproot which is usually bent or twisted at the base of the stem. Stems single or few, 8–40 cm. tall, loosely and rather widely bushy-branched from the base, up to 50 cm. across when in flower, the branches ascending or spreading-ascending, the branching markedly cymose, the early-flowering tip of the main axis soon overtopped and hardly discernible on full grown plants. Stem and main branches rather coarsely and densely pubescent with widely spreading hairs; pubescence of branchlets and peduncles spreading to loosely appressed. Basal leaves (soon drying and disappearing) oblanceolate to oblong-spatulate, hispid pubescent on both surfaces and ciliate on the margin, especially in the narrowed basal portion, subacute or obtuse, 0.7–3.5 cm. long (petiolar base about half as long), 3.0–8.5 mm. wide. Stem leaves similar, the upper gradually smaller, the petiolar base shorter and less distinct. Involucre narrowly to broadly conical, 3.8–4.5 mm. tall. Phyllaries imbricated in about 3–4 series, broadly lanceolate or lanceolate-oval, often awn-tipped by the excurrent midrib, glabrous, the broad scarious margins entire or very minutely erose; middle phyllaries 0.8–1.2 mm. wide. Ray florets 6–15, ligules oblong, 2.6–4.0 mm. long, 1.1.–2.0 mm. wide, violet or lavender to violet blue. Disk florets 8–22, corollas 2.5–3.0 mm. long, yellow. Achenes subterete, somewhat clavate, 10-ribbed, glabrous or sparsely pubescent, 1.7–2.2 mm. long. Pappus usually none, represented by a thickened ring on the summit of the achene, or rarely by a minute erose crown.

Late flowering form: spring leaves withered, plants nearly leafless, intricately much branched, the many delicate secondary branchlets terminated by the numerous, solitary, narrowly conical or cylindrical involucres, the heads much narrower than in the spring form, resembling those of young *C. asteroides*. This develops in summer or fall in favorably moist seasons, the spring plants persisting and flowering a second time.

An abundant and rather showy little spring-flowering plant of open rocky limestone soil in the eastern and southeastern sections of the Edwards Plateau and adjacent areas, central Texas. The type was collected "in margin of woods and thickets, in sterile soil, Comale Creek and near New Braunfels, April to June," 1846, by Lindheimer, Fl. Tex. Exs. 415 (in Gray Herb., not seen; isotypes in herb. University of California, herb. Missouri Botanical Garden, herb. New York Botanical Garden, and U. S. National Herb.).

Some additional specimens examined: TEXAS: Bandera Co., 10 miles s.e. of Bandera, *Cory 1029* (G). Bell Co., 3 miles s. of Salado, *Simon E. Wolff 2934* (TAM); near Sparta, *Wolff 3784* (TAM). Bexar Co., San Antonio, *B. C. Tharp*, April 1, 1921 (T). Blanco Co., Blanco, *Whitehouse*, April 6, 1930 (T). Caldwell Co., without locality, *Lucille Barber*, April 5, 1931 (T). Comal Co., New Braunfels, *Lindheimer Exs. 628* (Mo, US), *932* (C, Mo, NY, T, US). Edwards Co., Rocksprings, *Geo. L. Fisher 3694*, July 19, 1936 (US); 19 miles s.e. of Rocksprings, *Lloyd H. Shinners 7335, 7355* (SMU). Gillespie Co., Threadgill, *G. Jermy 615* (US; same number, without locality, Mo). Hays Co., San Marcos and vicinity, *S. W. Stanfield*, June, 1896 (NY). Kerr Co., n. of Hunt, *Whitehouse 10419* (SMU); Kerrville, *Mrs. J. M. Milligan*, May, 1897

(US), *E. J. Palmer 9946* (Mo, US). Kimble Co., Junction, *Whitehouse 10282* (SMU; apparently the same, without number, T). Kinney Co., Laguna to Brackettville, *Whitehouse 10419* (SMU). Mason Co., Loyal Valley, *E. Dapprich*, in 1881 (SMU). Real Co., 1 mile s. of Camp Wood, *Parks & Cory 18295* (TAM); 1 mile n. Leakey, *Shinners 7323* (SMU); 16 miles n. of Leakey, *Cory 8571* (USNA; apparently the same, with same number but locality given as "below Thousand Springs," TAM). Sutton Co., Sonora, *M. E. Jones 28023, 28025* (C), *Richard W. Pohl 4756* (SMU). Travis Co., Austin, *J. E. Bodin 30* (US; apparently the same, without number, C), *Palmer 13665* (Mo, US), *Tharp*, April 28, 1933 (C-Cl, T, TAM), April 28, 1940 (C-Cl, T), June 25, 1920 (C-Cl, T, TAM); Bull Creek, *E. R. Bogusch*, May 2, 1926 (US); near Marshall Ford Dam, *C. L. Lundell & Amelia A. Lundell 9091* (SMU). Uvalde Co., Sabinal, *Whitehouse*, March 30, 1933 (T); 12 miles s.w. of Uvalde, *Whitehouse 10402* (SMU); 20 miles n. of Uvalde, *Shinners 7309* (SMU). Val Verde Co., n. of Del Rio, *M. E. Jones 28024* (C); Devils River, *C. R. Orcutt 6013* (Mo); $12\frac{3}{4}$ miles s. of Loma Alta, *Cory 39484* (T).

Heller 1436 from Nueces Co., cited as *Keerlia bellidifolia* by Miss Larsen (1933, p. 38), is *Chaetopappa asteroides* var. *imberbis*.

6a. CHAETOPAPPA ASTEROIDES (Nutt.) DC., Prodr. 5: 301. 1836.

Chaetophora (misprinted *Chaetanthera*) *asteroides* Nutt., Journ. Phila. Acad. 7: 111. 1834.
Diplostelma filiformis Raf., New Fl. N. A. 2: 45. 1837 (dated 1836).
Diplostelma pumila Raf., New Fl. N. A. 2: 45. 1837 (dated 1836).
Diplostelma radians Raf., New Fl. N. A. 2: 45. 1837 (dated 1836).
Distasis asteroides (Nutt.) Kuntze, Rev. Gen. Pl. 1: 334. 1891. (As *D. asterodes*.)

Slender annual from a taproot. Stems single or less often several, 3.5–30 cm. tall when in flower, simple or usually divaricately branched, the branches spreading-ascending to horizontal, rather distant and elongate, the ultimate branchlets or peduncles terminated by a solitary small head. Branching markedly cymose: the main axis terminated by the first head to flower, the remaining heads flowering later on branches and branchlets which soon overtop and obscure the first one. Stem and branches strigosely and somewhat hispidly pubescent. Plants at first with a basal rosette of oblanceolate to spatulate-orbicular, obtuse, apiculate, loosely strigose, hispid-ciliate leaves 4–25 mm. long (petiolar base ½–⅔ the total length), 1–5 mm. wide. Stem leaves similar but narrower, the upper gradually smaller, those of the branches reduced to linear or subulate bracts. Involucres 3.5–4.5 mm. tall, narrowly cylindric to conical. Phyllaries imbricated in about 3–4 series, lanceolate, more or less hispid-pubescent on the back, fimbriate-ciliate toward the apex, the inner prominently so; middle phyllaries about 0.5–0.8 mm. wide. Ray florets 5–13, ligules oblong, 2.5–4.0 mm. long, 0.8–1.8 mm. wide, white, sometimes turning lilac or rosy violet in withering, very rarely colored from the first. Disk florets 6–15, corollas 2.5–3.0 mm. long, yellow. Achenes 1.6–2.0 mm. long, prismatic, 5-nerved or -ribbed, pubescent. Central florets commonly retarded in development, often not maturing achenes. Pappus of 5 hyaline scales 0.1–0.8 mm. long, alternating with as many awns 1–3 mm. long, or awns

rarely wanting. Pappus of ray like that of the disk florets or shorter, rarely the reverse. Pappus of abortive central florets like the rest, or much reduced, or sometimes awnless while the rest have awns.

Late flowering form: plants nearly leafless, intricately branched, the branchlets very slender, naked or with few minute subulate bracts, the numerous involucres very narrowly cylindrical. As in *C. bellidifolia*, this form may develop in summer or fall in favorably moist years. Rafinesque's *Diplostelma filiformis* probably represented this form.

Llano form: stem pubescence loosely appressed to widely spreading, but plants not as coarse as in var. *imberbis*, and pappus awns usually present. Collections from the granite region of Llano and Burnet Counties, south central Texas, and a single specimen from the Arbuckle Mountains, Murray Co., Oklahoma, differ from typical *C. asteroides* in having spreading stem pubescence, but are otherwise like the species.

A delicate little spring-flowering annual of sandy or rocky open ground or open woods, from south central Texas north and east to Kansas, Missouri, and Louisiana. Uusally abundant where found, growing by itself or with *C. bellidifolia*, *Astranthium integrifolium* (Michx.) Nutt., *Aphanostephus ramosissimus* DC., or *A. skirrhobasis* (DC.) Trel. Dwarf, 1-headed plants of all these species can look surprisingly alike, in spite of marked differences in detail. In the field, *C. asteroides* and *C. bellidifolia* can best be distinguished by the latter's more robust stature, colored rays, and broader, glabrous involucres with broad phyllaries. It is possible that the two hybridize, the pale rays and rather intermediate appearance of occasional plants where the two grow together suggesting hybridization, but evidence from detailed examination is not convincing. *Astranthium* and *Aphanostephus* are best distinguished from both species of *Chaetopappa* in the field by the broad, very shallow involucres, with outer phyllaries more than half as long as the inner, and by the fact that the rays do not coil, as in *Chaetopappa*, but are either deciduous before shrivelling (in *Astranthium*) or remain extended in drying (in *Aphanostephus*).

The type was collected by Thomas Nuttall in "Arkanzas"; it is probably in the British Museum. There are isotypes in the Gray Herbarium and in the herbarium of the New York Botanical Garden.

Some specimens examined: ARKANSAS: Crawford Co., Alma, *Geo. C. Haas & Flora A. Haas 230* (US); Van Buren, *Delzie Demaree 15309* (Mo). Western Arkansas, *Herb. F. L. Harvey*, June, 1899 (US) (Harvey collected chiefly in the vicinity of Fayetteville, Washington Co.). KANSAS: Chautauqua Co., 1 mile s. of Sedan, *L. H. Shinners, Grant Cottam & H. A. Stephens 3553* (C-Cl). LOUISIANA: Calcasieu Parish, Lake Charles, *E. N. Plank 42* (US). MISSOURI: Cedar Co., without locality, *B. F. Bush 14908* (Mo). Jasper Co., 3 miles n.w. of Joplin, *E. J. Palmer 32359* (Mo). Newton Co., 4 miles s. of Joplin, *E. J. Palmer 29929* (Mo); Grand Falls, *Bush 10456* (Mo, NY, US). Vernon Co., without locality, *G. C. Broadhead*, June 25, 1873 (G). OKLAHOMA: Atoka Co., Limestone Gap, *Geo. D. Butler 104* (Mo). Carter Co., near Ardmore, *G. W. Stevens 75* (G, Mo, NY, US). Cleveland Co., 6 miles e.

of Norman, *Demaree 12798* (Mo, NY). Comanche Co., 7 miles w. of Cache, *Reginald Rose-Innes & Brunelle Moon 989* (G); Ft. Sill, *Mrs. J. Clemens 11814* (G, Mo.). Creek Co., Sapulpa, *Bush 928* (C, Mo). Johnston Co., near Mannsville, *Florence Griffith*, May 20, 1916 (Mo, NY); near Tishomingo, *H. W. Houghton*, April 8, 1916 (G, NY). Le Flore Co., Poteau, *E. J. Palmer 8255* (Mo, NY, US). Lincoln Co., Fonts, *J. W. Blankinship*, Aug. 27, 1895 (G, Mo, US). Murray Co., Arbuckle Mts., *G. J. Goodman 2476* (G, Mo, NY; exceptional form with spreading stem pubescence); Davis, Arbuckle Mts., *Demaree 12289* (NY), *W. H. Emig 552* (Mo); near Crusher Spur, *Stevens 51.1* (G). Muskogee Co., Muskogee, *M. A. Carleton*, April, 1891 (US). Ottawa Co., near Lincolnville, *E. J. Palmer 29929* (Mo, NY). Payne Co., Stillwater, *F. A. Waugh*, June 10, 1893 (US; apparently the same, as no. 10, Mo). Seminole Co., Seminole, *Demaree 12713* (Mo, NY); 6 miles s.e. of Seminole, *U. T. Waterfall 584* (NY). Sequoyah Co., near Sallisaw, *E. J. Palmer 33265* (Mo, NY). TEXAS: Anderson Co., near Palestine, *Whitehouse 10577* (SMU). Angelina Co., s. of Lufkin, *Whitehouse 10206* (SMU). Austin Co., Catspring, *Lindheimer*, April-July, 1844 (Mo, SMU); Kenney, *Pennell 10309* (NY). Bastrop Co., 2 miles e. of Bastrop, in Bastrop State Park, *Shinners 7271* (SMU). Bell Co., 3 miles n. of Holland, *Wolff 808* (TAM). Bexar Co., 14 miles n. of San Antonio, *Sister Mary Clare 511* (C). Brazos Co., Bryan, *E. J. Palmer 7786* (Mo, NY, US); near Fish Lake, College Station, *D. C. Bain*, April 29, 1940 (TAM). Burnet Co., 5 miles s. of Burnet, *Wolff 3819* (TAM); Inks Lake State Park, w. of Burnet, *Shinners 7221* (SMU; form with spreading stem pubescence). Calhoun Co., Port Lavaca, *Tharp*, May 22, 1930 (T). Clay Co., Henrietta, *Bush 5431* (G, Mo). Comanche Co., Comyn, *Biology Students*, April 30, 1930 (T). Coryell Co., near Holvert, *Wolff 1407* (US). Dallas Co., Dallas, *Reverchon*, various dates and numbers (C, G, Mo, US); *Bush 593* (Mo, US). DeWitt Co., Cuero, *Bray 135a* (US; apparently the same, without number, T). Eastland Co., Carbon, *Center Point School*, May 7, 1930 (T). Frio Co., 5 miles n.w. of Derby, *Cory 12780* (USNA). Gillespie Co., Bear Mt., *Parks & Cory 12974-76* (TAM; same, as *Cory 12977*, USNA). Gonzales Co., Ottine, *E. R. Bogusch 986* (T; not typical). Grimes Co., Anderson, *Fisher*, April 9, 1941 (US). Hamilton Co., $2\frac{1}{2}$ miles s. of Hico, *Shinners 7182* (SMU). Hardin Co., Fletcher, *E. J. Palmer 9542* (Mo, US). Harris Co., Hockley, *F. W. Thurow*, in 1889 (US). Hood Co., Granbury, *Eggert*, May 6, 1900 (Mo, NY). Houston Co., 7 miles s. of Crockett, *K. M. Wiegand & M. C. Wiegand 2420* (G). Jack Co., 9 miles n.w. of Jacksboro, *Shinners 7949* (SMU). Jackson Co., Edna to Victoria on Highway 59, *Whitehouse 10401* (SMU). Kaufman Co., vicinity of Terrell, *F. J. Tyler*, April 23, 1904 (US). Lee Co., without locality, *V. H. Williams*, March 12, 1939 (TAM). Leon Co., 13 miles s.w. of Buffalo, *Shinners 7132* (SMU); 23 miles s.w. of Buffalo, *Shinners 7137* (SMU). Live Oak Co., southern part, *Tharp*, March 22, 1931 (NY, T). Llano Co. (the following 7 collections are all of the form with spreading stem pubescence), Bauman's, *Parks & Cory 15137* (TAM); Enchanted Rock, *R. R. Innes 899* (G), *Whitehouse 10283* (SMU); near Inks Dam, *C. L. Lundell & Amelia A. Lundell 9048* (SMU); Llano, *Bray 135* (US); along Colorado River 1 mile s. of bridge e. of Llano, *Shinners 7195* (SMU); Granite Mt., near Llano, *Wolff 3845* (TAM). Mills Co., Mullers Tp., *Mamie Egg*, April 14, 1931 (T). Montgomery Co., 30 miles n. of Houston, *Herb. Charles Mohr*, April 24, 1839 (US); Willis, *M. B. G. Herb. no. 900588*, in March, year not given (Mo). Navarro Co., Raleigh, *Reverchon*, April 15, 1903 (Mo). Nueces Co., Corpus Christi, *H. W. Ravenel 76* (Mo,

NY); Nueces Bay, *A. Arthur Heller 1436* (NY; duplicates are mostly var. *imberbis*); Viola, *H. C. Benke 5444* (G). Parker Co., Weatherford, *S. M. Tracy 7897* (G, Mo, NY, T, US). Polk Co., 1½ miles e. of Corrigan, *Cory 22156* (USNA). Tarrant Co., Fort Worth, *O. L. Killian*, in 1927 (T); Lake Worth, *A. Ruth 1593*, July 5, 1929 (SMU), *704*, April 14, 1925 (NY); same number, without locality, April 14, 1923 (G), April 14, 1919 (US). Taylor Co., n. of Abilene, *Eggert*, May 6, 1900 (Mo). Titus Co., *Talco School*, July, 1927 (T). Travis Co., Austin, *M. S. Young*, May 13, 1918 (C-Cl, Mo, USNA); *F. Rugel*, in 1868 (Mo); *Bray 52* (NY); 28 miles n.w. of Austin on road from Beecaves to Spicewood, *Shinners 7245* (SMU). Trinity Co., Trinity, *Plank*, May 17, 1892 (NY). Van Zandt Co., 3 miles e. of Wills Point, *Shinners 7540* (SMU). Victoria Co., Victoria, *E. J. Palmer 9100* (Mo). Walker Co., vicinity of Huntsville, *Royal A. Dixon 409* (G, NY). Waller Co., Hempstead, *Elihu Hall 307* (G, Mo, NY). Washington Co., without locality, *Eunice Brackett*, June 20, 1938 (T). Wilson Co., Kicaster School, *Parks & Cory 15137* (TAM). Wise Co., 3 miles w. of Decatur, *Shinners 7925* (SMU).

6b. CHAETOPAPPA ASTEROIDES var. **grandis** Shinners, var. nov.

Distasis modesta DC., Prodr. 5: 279. 1836.
Chaetopappa modesta (DC.) A. Gray, Proc. Amer. Acad. 16: 82. 1880. (As to name on which based, but the new combination was incorrectly used for *Chaetopappa bellioides*.)

Robustior, plerumque multicaulis; capitula majora, fl. radii 12–18, disci 15–25; phyllaria mediocria ad 0.7–1.0 mm. lata.

More robust than the species, when well developed usually with several or many stems and bushy-branched. Involucres narrowly to broadly conical, even when young; middle phyllaries about 0.7–1.0 mm. wide. Ray florets 12–18, ligules 3–4 mm. long; disk florets 15–25. Pappus apparently always of both scales and awns.

Confined to the lower Rio Grande Valley, as yet known only from southern Texas, but to be expected in adjacent Tamaulipas. Flowering slightly earlier than the species, beginning in February. The type was collected on a gravelly hill off U. S. Highway 83, 3 miles east of Sullivan City, Hidalgo Co., Texas, by C. L. Lundell and Amelia A. Lundell, no. 9982, April 5, 1941 (in herb. Southern Methodist University).

Rather than perpetuate a name based on the inadequate scraps which constituted the type and isotypes, and which were largely responsible for the long misunderstanding as to the proper identity of the plant, I have deliberately chosen a new name based on a new and better type specimen.

Additional collections examined: TEXAS: Hidalgo Co., La Joya (Sam Fordyce), *Mrs. E. J. Walker 26* (G, T). Webb Co., Laredo, *Berlandier 1416* (G, Mo, NY, US; isotypes of *Distasis modesta* DC.); *Reverchon 4007* (Mo, NY).

6c. CHAETOPAPPA ASTEROIDES var. IMBERBIS A. Gray, Proc. Amer. Acad. 16: 82. 1880.

Coarser and stouter than the species; pubescence of stem and main

branches longer and widely spreading, appearing rather shaggy. Ray florets 6–14, disk florets 11–18. Pappus of scales only, without awns.

The type was collected in Texas by Charles Wright (in Gray Herb.). Gray speaks of it as having come from "east Texas," which would suggest that it was collected in 1844 in either Angelina, Jasper, or Tyler County, far out of the range of the variety as now known. An apparent duplicate in the U. S. National Herbarium, consisting of a mixture of the species, var. *imberbis*, and *Krigia virginica* (L.) Willd., bears a label with the information that it was collected between the Colorado and the Guadalupe, in post oak woods, in April. Dr. Geiser tells me that this collection probably was made in 1849 in Fayette Co., or possibly in Gonzales Co., while Wright was en route to San Antonio, to begin his 1849 expedition to western Texas. Fayette and Gonzales counties are in the area to which the variety is apparently confined. As far as known at present, it occurs in a limited area in south central Texas, centering on the northern part of the Rio Grande Plain, either by itself or with the species.

Additional specimens examined: TEXAS: Atascosa Co., Campbellton to Pleasanton, *Whitehouse 10243* (SMU); n. of Pleasanton on Highway 281, *Whitehouse 10346* (SMU). Bexar Co., 16 miles s. of San Antonio, *Ellen D. Schulz 445* (US); 18 miles s. of San Antonio, *Sister Mary Clare Metz 2172* (NY). Caldwell Co., without locality, *J. B. McBryde*, spring-summer, 1931 (T). Gonzales Co., 10¼ miles w. of Monthalia, *Parks & Cory 7804* (TAM); Ottine, *Bogusch 1735* (T); Palmetto State Park, *Innes 618* (G); without locality, *Bogusch 1438* (C-Cl). Guadalupe Co., Seguin, *Whitehouse 10260* (SMU). Nueces Co., Nueces Bay, *Heller 1436* (G). Wilson Co., Sutherland Springs, *Parks & Cory 7804* (TAM); near Sutherland Springs, *Cory 8571* (USNA).

Series 4. BELLIOIDEAE. Annuae vel perennes caespitosae, capitulis multifloris (disci 32–106); achaenia fl. radii tricostata (rarius bicostata), disci bicostata compressa.

Annuals or tufted perennials; heads many-flowered (disk florets 32–106); achenes of ray florets 3-ribbed, rarely 2-ribbed, achenes of disk florets 2-ribbed, compressed.

7. **Chaetopappa bellioides** (A. Gray) Shinners, comb. nov.

Diplostelma bellioides A. Gray, Plantae Fendlerianae (Mem. Amer. Acad. n.s. 4): 72–73. 1849.

This has generally been known as *Chaetopappa modesta* (DC.) A. Gray, but the type collection of *Distasis modesta*, on which this name was based, belongs to *C. asteroides* var. *grandis*.

Perennial, but flowering the first year and appearing annual, with a taproot (ultimately a forked caudex) producing several to many simple or sparingly branched, ascending or spreading, strigose-pubescent stems 3.5–28 cm. tall when in flower; these usually at first short and compact, elongating in age, or early elongate in shady places. Plants at first with a basal rosette-like cluster of oblanceolate or spatulate, subacute to obtuse and apiculate, hispidly strigose and ciliate leaves 0.5–4.7 cm. long (petio-

lar base 0.3–2.7 cm.), 2–8 mm. wide; these soon withering and disappearing. Proper stem leaves similar but narrower, the upper gradually smaller. Heads solitary and terminal on the stems or branches, the later ones on peduncles naked for as much as 2.5 cm. below the head. Involucre hemispherical or broadly campanulate, 4.0–5.1 mm. high, the disk 4–12 mm. across in flower (as pressed). Phyllaries imbricated in about 4–5 series, broadly lanceolate or oblong, appressed pubescent on the back, the broad white scarious margin lacerate-ciliate, especially towards the apex, the central green portion commonly tinged red or purple toward the tip; middle phyllaries 1.0–1.3 mm. wide. Ray florets 12–18, ligules linear-oblong, 3.5–5.2 mm. long, white to lavender or violet blue. Disk florets 33–106, corollas 2.8–3.5 mm. long, yellow. Achenes about 2 mm. long, pubescent; those of the ray florets irregularly prismatic, 2- or 3-ribbed, those of the disk florets compressed, obtusely lanceolate in outline, 2-ribbed. Pappus of 5 narrowly oblong, hyaline, erose scales 0.6–1.8 mm. long, often united at base, and as many scabrous, setiform awns 2.2–3.0 mm. long.

Dry, rocky, open ground, southwestern Texas and north-central Mexico, as far south as Aguascalientes. Plants flowering in almost any month of the year, depending on rainfall. The type was collected at Buena Vista battle-field, about 10 miles north-east of Saltillo, Coahuila, Mexico, by Dr. Josiah Gregg, March 19, 1847 (in Gray Herb., without exact date; isotypes in herb. Missouri Botanical Garden and herb. New York Botanical Garden).

Additional specimens examined: AGUASCALIENTES: near Aguascalientes, *J. N. Rose & Joseph H. Painter 4777* (US). CHIHUAHUA: Chihuahua, *Harde LeSueur*, Aug. 20, 1935 (Mo, T); near Chihuahua, *C. G. Pringle 972* (Mo, NY, US); vicinity of Chihuahua, *Dr. E. Palmer 107* in 1908 (Mo, US); Santa Eulalia Mts., *Pringle 205* (C, G, NY), *E. Wilkinson*, in 1885 (NY, US). COAHUILA: near Diaz, *Pringle 205* (C), *8295* (G, Mo, NY, US). La Rosa, w. of Saltillo, *Forrest Shreve & E. R. Tinkham 9581* (C). Municipio de Ramos Arizpe, e. of Hacienda La Rosa, *Wynd & Mueller 38* (G, Mo, US). Saltillo, *Dr. E. Palmer 507* in 1880 (Mo, US); *Geo. L. Fisher 138* (US), "*Fr. Adole L., Pl. de Mexique 6506, misit Fr. G. Arsene*" (US); Saltillo and vicinity, *Dr. E. Palmer 47* in 1898 (C, G, Mo, NY, US); 24 miles w. of Saltillo, *Ivan M. Johnston 7680* (G), *Shreve 8739* (USNA). Sierra de Parras, *C. A. Purpus 1022* (C, G, Mo, NY; collections dated Feb., 1905, and March, 1905, all under same number). Soledad, 25 miles s.w. from Monclova, *Dr. E. Palmer 508* in 1880 (US). NUEVO LEON: Cerralbo, *Gregg*, May 29, 1847 (Mo). Near Rio Ramos, 20 km. n.w. of Montemorelos, *J. N. Weaver 1030* (G, TAM). Monterey, *Dr. Edwards & Maj. Eaton*, in 1846 (NY); Bishop's Hill, Monterey, *Gregg*, Feb. 6, 1847 (Mo); Sierra Madre Mts., Monterey, *Mueller & Mueller 255* (G; same, without number, T). SAN LUIS POTOSI: Charcas, *C. L. Lundell 5748* (US, USNA), *5067* (US). Minas de San Rafael, *Purpus 4967, 5150, 5164* (C), *5019* (C, G, Mo, NY, US; all with narrower and more acute leaves than usual, and rather smaller heads, with as few as 13 rays, 32 disk florets). Near Salitre, 15 miles n.w. of Salado, *Shreve 9359* (G, USNA). ZACATECAS: Cedros, *Francis E. Lloyd 115* (US). Hacienda de Cedros, *Lloyd 188* (C, US;

locality further indicated as "Zacatecas, norte"). NEW MEXICO: without locality, *Charles Wright 1173*, in 1852 (G, NY, US). TEXAS: Brewster Co., Marathon, *Cory 2585* (G); 25 miles s. of Marathon, *L. C. Hinckley*, Oct., 1936 (G, NY); without locality, *Tharp*, Oct. 9, 1936 (C-Cl, Mo, SMU, T). Hidalgo Co., 5 miles n. of Mission, *Parks & Cory 18036* (TAM; same, as *Parks 18036*, C). Kinney Co., Ft. Clark, *Edgar A. Mearns 1264, 1309* (US). Maverick Co., Eagle Pass, *V. Havard*, Sept. 1882 (US); Coal Mine, Eagle Pass, *Bray*, May 21, 1898 (T). Presidio Co., foothills of the Chinati Mts., *Young*, Sept. 11, 1914 (Mo, T). Terrell Co.?, Langtry-Dryden, *Tharp*, June 14, 1931 (Mo, T). Uvalde Co., Uvalde to Cline, *Whitehouse 10585* (SMU). Val Verde Co., near Comstock, *Whitehouse 10533* (SMU); Del Rio, *E. O. Wooton*, Nov. 5, 1913 (US); vicinity of Del Rio, *Rose & Fitch 17985* (Mo, US); 10 miles n. of Del Rio, *Parks & Cory 20851* (TAM; same, as *Cory 20852*, USNA); 13 miles n.w. of Del Rio, *Cory 43867* (SMU); w. of Del Rio, *Whitehouse 10583* (SMU); Langtry, *F. S. Earle & Esther S. Earle 445* (Mo, NY, US), *Orcutt 6149* (Mo); 2 miles e. of Langtry, *R. R. Innes & Barton H. Warnock 597* (G).

7b. CHAETOPAPPA BELLIOIDES var. **hirticaulis** Shinners, var. nov.

Differt pubescentia longiore patula vel hispido-lanosa, capitulis majoribus (involucris ca. 5.0–6.5 mm. altis).

Stems and branches densely pubescent with more or less spreading or matted whitish hairs about 1.0 1.5 mm. long. Heads larger, the involucres 5.0–6.5 mm. high.

The type was collected on the Cerro Tres Vetas, vicinity of San Jose, alt. 2700 ft., Sierra de San Carlos, Tamaulipas, Mexico, by H. H. Bartlett, no. 10359, July 15, 1930 (in herb. Southern Methodist University; isotype in U. S. National Herb.). Known only from the region of the type locality; both collections seen were made in July.

Additional specimen examined: TAMAULIPAS: Sierra de San Carlos, vicinity of San Jose, Cerro de los Armadillos, *Bartlett 10171* (US).

8. **Chaetopappa pulchella** Shinners, sp. nov.

Annua (adeo perennis?) parva 3–7 cm. alta ramosa, omnino hispido-pubescens pilis albidis patentissimis brevibus. Folia infima spathulata vel anguste oblanceolata, 6–12 mm. longa, 1.5–4.0 mm. lata, decidua, superiora similia minora (nisi surculis tardis). Involucra campanulata ca. 5.0–6.0 mm. alta, phyllariis 3 -4-seriatis lanceolatis. Flores radii 15–20, ligulis lavandulis 5 mm. longis, 1.5 mm. latis. Flores disci 38, corollis 3.5 mm. longis. Achaenia radii 2-, 3-, vel 4-costata; disci bicostata compressa. Pappus duplex paleis 5 scariosis 1.1 mm. longis et aristis 5 setiformibus 3.3 mm. longis.

Low annual with a taproot, perhaps persisting and becoming perennial; stems 3–7 cm. tall, branched from near the base, densely and uniformly pubescent with short whitish hairs about 0.5 mm. long, stiffly spreading at right angles. Leaves hispid pubescent and densely ciliate with short hairs like those of the stem, the lower spatulate to narrowly oblanceolate, 6–12 mm. long (petiolar base 2 -5 mm.), 1.5–4.0 mm. wide, soon turning

yellow and falling; middle and upper stem leaves similar but smaller. Involucre broadly campanulate, 5.0–6.1 mm. tall, the disk 7–8 mm. across (as pressed). Phyllaries imbricated in about 3–4 series, lanceolate, hispid-pubescent on the back, the scarious margins prominently fimbriate-ciliate toward the apex, the green central portion rosy or purple tinged at tip, with a keel-like midrib prominent in the lower ⅓–⅔; middle phyllaries 1.1–1.2 mm. wide. Ray florets 15–20, ligules elliptic-oblong, 5 mm. long, 1.5 mm. wide, lavender. Disk florets (one count) 38, corollas 3.5 mm. long, yellow. Achenes about 2 mm. long, sparsely pubescent, those of the ray florets compressed or irregularly prismatic, 2-, 3-, or 4-ribbed; those of the disk florets compressed, 2-ribbed. Pappus of 5 hyaline scales about 1.1 mm. long, and as many setiform, scabrous awns 3.3 mm. long.

The type was collected among small stones in a bajada (swampy place), on the road from Monclova westward to beyond Cuatro Cienegas, at 4 miles west of Cuatro Cienegas, Coahuila, by Ivan M. Johnston, no. 7151, August 24–26, 1938 (in Gray Herb.).

The type collection consists of a number of diminutive, divaricately branched, yellow green annuals in flower and fruit. The second collection, cited below, consists of a single small plant from a slender taproot and apparently three new stems arising from the dead or broken base of an old one. It is not clear whether this represents a perennial, or merely a revival in growth due to rains, in the fashion of *C. bellidifolia* and *C. asteroides*, of a plant which is normally very short-lived. This second collection shows much more resemblance to *C. bellioides* than does the type, and it may later prove desirable to consider it simply as a variety of that species.

Additional specimen examined: COAHUILA: Sierra Mojada Mts., *M. E. Jones 263*, April 19, 1892 (US; mounted on same sheet with *C. bellioides*, *Dr. E. Palmer 505*).

EXCLUDED SPECIES

Distasis? concinna Hook. & Arn., Bot. Capt. Beechey's Voyage suppl. p. 350. = *Erigeron concinnus* (H. & A.) T. & G., Fl. N. A. 2: 174. 1841.

Distasis? heterophylla Hemsley, Biol. Cent.-Amer. Bot. 2: 119. 1881. The type was collected at Jalapa, Vera Cruz, Mexico, by Thomas Coulter, no. 406 (in Kew Herb.; fragment and photograph in U. S. National Herb.). Described as having trifid or pinnatifid leaves, phyllaries nearly equal in 2 or 3 series, receptacle conical, and ray florets in 2–3 series, with very short ligules. All the species of *Chaetopappa* have simple, entire leaves, unequal phyllaries, flat or nearly flat receptacle, and ray florets in one series, with well developed ligules. The involucre of the Coulter specimen, consisting of subequal, lance-linear, hispid-pubescent phyllaries, would place it in *Erigeron*, a genus of which there are several Texano-Mexican species with convex to conical receptacle, while those species segregated under *Achaetogeron* but better retained in *Erigeron* have a paleaceous pappus. In any case, *Distasis heterophylla* cannot be retained in *Chaetopappa* as here defined.

Keerlia mexicana A. Gray, Proc. Amer. Acad. 22: 422. 1887. = *Astranthium xylopodum* Larsen, Ann. Mo. Bot. Gard. 20: 31. 1933.

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REVISION OF THE GENUS LEUCELENE GREENE

LLOYD H. SHINNERS

INTRODUCTION

There is remarkable similarity in general appearance, and in details of the involucre, between *Chaetopappa bellioides* (A. Gray) Shinners and another small, asteraceous, dry ground plant of the southwestern United States and adjacent Mexico, which has been known variously as *Aster ericaefolius* Rothrock, *Aster Leucelene* Blake, *Leucelene ericoides* (Torr.) Greene or under the names of segregates from the original species. It hardly differs from *Chaetopappa* except in the entirely capillary pappus, and characteristic creeping root and often partially underground stem. Its assignment to the genus *Aster* is but the last of a series of misapprehensions as to its affinities. It was first placed in *Inula*, and then in *Chrysopsis*, on the erroneous supposition that the rays were yellow. Later it was transferred to the artificial genus *Diplopappus*, in the mistaken belief that the pappus was double. It differs from *Aster* (considering now only the subgenus *Euaster*, and postponing for later consideration the remaining miscellaneous elements which make of *Aster* not a genus but a hodge-podge) in having an underground creeping root and often partly underground stem, instead of superficial rhizomes or caudex; the phyllaries are not herbaceous-tipped, the pappus bristles are relatively few and definite in number (usually 25); and the plant regularly flowers in spring and again later in the season, instead of once and finally in summer or fall. It does not greatly resemble any of the true Asters, but instead, as already mentioned, shows some resemblance to *Chaetopappa bellioides*.

SYSTEMATIC TREATMENT

LEUCELENE Greene, Pittonia 3: 147–149. 1896.

Normal spring form: Plants perennial, low (about 6–12 cm. above ground at flowering time), forming beds of small to large dense separate tufts which are connected by horizontal or oblique creeping rootstocks usually 3–7 cm. or more below ground (shallower in eroding soils). Rootstocks producing vertical or oblique and branching, slightly woody, subterranean stems, or short naked branches which give rise to subterranean stems; stems again dividing to form numerous above-ground branches, which in turn bear slender erect or ascending branchlets or peduncles; leafy branchlets continuing to appear and elongate during and after flowering (eventually producing secondary flower heads, except in very dry or otherwise unfavorable seasons or localities, when persisting as sterile

shoots). Subterranean stems at first covered with numerous, alternate, acute, triangular scales, these passing into leaves above ground; scales disappearing in age. Above-ground branches and leaves sparsely to densely strigose and granular. Leaves alternate, simple and entire, obtuse and apiculate, prominently hispid-ciliate. Lower primary leaves linear-oblanceolate to elongate-spatulate, 7–20 mm. long by 0.6–2.0 mm. wide, loose and more or less widely spreading; leaves of younger shoots linear-oblanceolate or linear, from appressed and imbricated to loose and merely ascending or occasionally even spreading, the upper gradually smaller, the uppermost scarcely larger than the outermost phyllaries.

Heads solitary and terminal on the slender branchlets. Involucres 5.7–7.0 mm. high, at first broadly turbinate or campanulate, ultimately opening out flat. Phyllaries loosely appressed and imbricated in about 4 7 series, the outermost 1.5–2.5 mm. long, less than half as long as the innermost, the middle ones about 1 mm. wide; concave, lanceolate or oblong-lanceolate, aristate-acute, more or less appressed-pubescent, and at least toward the apex serrulate- or lacerate-ciliate; all chartaceous, green or toward the apex red or purple, with broad scarious margins and a slender yellowish or brownish midrib extending nearly to the apex and thickened and bluntly keel-like toward base. Receptacle flat or slightly convex, naked and glabrous, slightly roughened by the points of attachment of the achenes. Heads heterogamous and heterochromous. Ray florets 12–24, pistillate, not developing achenes of quite the size and fullness of those of the disk, ligulate; ligules about 4–6 mm. long, 1.0 1.5 mm. wide, oblong or oblong-lanceolate, 4-nerved, white (occasionally rosy or rosy violet in withering, very rarely colored from the first); tube about 3 mm. long, narrowly cylindric; styles 2-parted for about a fourth their length, the branches linear, obtuse or subacute, obscurely granulose in the terminal third but not appendaged. Disk florets 12–24 (as many as or fewer than the rays, rarely more), hermaphrodite, fertile; corollas yellow, about 4.5 5.0 mm. long, tubular, subcylindric, slightly expanded upward, sometimes with a discernible short (0.2–0.3 mm.) basal tube, but usually limb and tube not recognizably differentiated, the summit regularly 5-lobed, the lobes deltoid- or lanceolate-oval, 0.3–0.5 mm. long, erect or slightly spreading; styles 2-parted for about a fifth their length, the branches flat and with thickened margins, tipped with a triangular, dorsally granular-scabrous appendage about a fourth as long, in all about 0.8 mm. long, slightly or not at all exserted in flower; anthers included, obtuse at base, tipped with a prominent, lanceolate, hyaline appendage about 0.3 mm. long. Achenes about 1.7 3.0 mm. long, 5-nerved, subcylindric but often becoming irregularly prismatic or compressed in maturing, contractd at summit and rather abruptly narrowed to a whitish carunculate base, the long hairs toward the summit appearing like a secondary short pappus. Pappus of disk and ray florets similar, of 25 (less often 20 or 30) scabrous, approximately equal bristles (rarely one or two as little as one fourth as long as the longest), 4.5 5.5 mm. long, united at base in a ring on the summit of the achene, those of the disk florets equalling or slightly exceeding the corollas.

Late season and other growth forms: As the season progresses, the relatively long and broad lower leaves wither, the secondary very narrow-leaved branches elongate, and under favorable conditions there is a second flowering. The plants are taller, much looser, and greener, the leaves narrower and less pubescent, the involucres narrower and fewer-flowered (narrowly conical or turbinate-cylindric, with 7–16 disk florets and 8–16 rays), and the rays are slightly shorter (3.5–5.0 mm. long). In general aspect and to some extent in detailed technical characters, the plant thus becomes markedly unlike the spring form, and might readily be taken for a distinct species.

Injured plants and those on eroding sites (a habitat in which the plant occurs very commonly) may send up few, much elongate, straggling branches with widely spreading, very narrow leaves, and sometimes with widely spreading instead of ascending branchlets. Some of the outer primary above-ground stems may be prostrate, with numerous side branches, and the creeping root may be shallower or even become partially exposed. If spring is late, the retarded plants may first appear in a transitional form and pass almost directly into the summer form.

Plants of transitional, summer, or erosion forms were the basis for the original *Inula? ericoides* Torr., for *Aster ericaefolius* var. *tenuis* A. Gray, *Leucelene ericoides serotina* Greene, and *Leucelene arenosa* Heller, and their direct synonyms. Plants of the compact, low, broad-leaved, very pubescent and granular spring form were the basis for *Diplopappus ericoides* var. *hirtella* A. Gray, *Leucelene alsinoides* Greene, *Aster bellus* Blake, and their direct synonyms.

Type species: *Inula? ericoides* Torr. [=*Leucelene ericoides* (Torr.) Greene].

The only variant of this highly polymorphic plant which possibly is to be considered a distinct variety or separate species is represented by a few specimens from northern and central Mexico, in which the leaves are fewer and more widely spaced than in the general run of specimens, and the lower have prominently long-attenuate petiolar bases. The scanty material available all belongs to the summer form; only a few separate stems are shown, with no complete tufts, and little or none of the root system. Their resemblance to the fragmentary type specimen of *Aster ericaefolius* var. *tenuis* is considerable, and at present I am unwilling to propose a new name for them.

LEUCELENE ERICOIDES (Torr.) Greene, Pittonia 3: 148. 1896.

Inula? ericoides Torr., Ann. Lyceum of Nat. Hist. N. Y. 2: 212. 1828.
Chrysopsis ericoides "T[orrey] & J[ames]"; Eaton, Man. ed. 5, p. 174. 1829.
Eucephalus ericoides (Torr.) Nutt., Trans. Amer. Philos. Soc. n. s. 7:299. 1840 (dated 1841).
Diplopappus ericoides (Torr.) T. & G., Fl. N. A. 2: 182. 1841.
Diplopappus ericoides var. *hirtella* A. Gray, Pl. Fendl. (Mem. Amer. Acad. n. s. 4): 69. 1849.

Aster ericaefolius Rothrock, Bot. Gaz. 2: 70. 1877.
Aster ericaefolius var. *tenuis* A. Gray, Syn. Fl. N. A. 1 pt. 2: 198. 1884.
Leucelene ericoides "variety or subspecies" *serotina* Greene, Pittonia 3: 149. 1896.
Leucelene ericoides var.? *tenuis* (A. Gray) Greene, Pittonia 3: 149. 1896.
Leucelene arenosa Heller, Cat. N. Amer. Pl. ed. 1, p. 143. 1898. (Nomen nudum.) Validated by Rydberg, Fl. Colo. (Colo. Agr. Exp. Sta. Bull. 100) p. 358, 1906, by two lines of key and citation of "*Aster ericaefolius tenuis* A. Gray" as synonym.
Leucelene alsinoides Greene, Pittonia 4: 99. 1899.
Leucelene hirtella (A. Gray) Rydb., Bull. Torr. Bot. Club 33: 153. 1906.
Leucelene serotina (Greene) Rydb., Bull. Torr. Bot. Club 33: 153. 1906.
Aster bellus Blake, Proc. Biol. Soc. Wash. 35: 174–175. 1922.
Aster hirtifolius Blake in Tidestrom, Fl. Utah & Nevada (Contr. U. S. Nat. Herb. 25): 562. 1925.
Aster Leucelene Blake in Tidestrom, Fl. Utah & Nevada (Contr. U. S. Nat. Herb. 25): 562. 1925.
Aster arenosus (Heller) Blake, Journ. Wash. Acad. Sci. 30: 471. 1940.

A common and rather weedy little plant of the Southwest and northern Mexico, from California, Utah, Wyoming, Nebraska, and Texas to Coahuila, San Luis Potosi, Durango, and Sonora. Found especially on eroding slopes, roadsides, and open ground, in sand, silt, or rocky soil.

The type, a fragment consisting of part of a branch with a single head, representing the transitional or summer form, was collected by Dr. Edwin James in Long's expedition to the Rocky Mountains in the summer of 1820. The locality is given by Torrey as "on the Canadian?" The plant may well have come from the Texas Panhandle, where it is very common. The type specimen is in the herbarium of the New York Botanical Garden.

Some additional specimens examined: CHIHUAHUA: Chihuahua, *Harde LeSueur*, Oct. 10–15, 1935 (T). Majalca, *LeSueur*, Aug. 20, 1935 (T). District of Guerrero south of Basuchil, about 10 miles n.w. of Miñaca, *Ynes Mexia 2520* (C; densely strigose form, matching the type of *Aster bellus* Blake). COAHUILA: Parras, *C. A. Purpus*, March, 1905 (C). Saltillo and vicinity, *Dr. E. Palmer 48* in 1898 (C; doubtfully this). DURANGO: Tepehuanes, *Dr. E. Palmer 41* in 1906 (C; densely strigose form). SAN LUIS POTOSI: Charcas, *C. L. Lundell 5066* (USNA; doubtfully this). SONORA: s. of Nogales on road to Hermosillo, *T. C. Frye & E. M. Frye 2261* (C). ARIZONA: Apache Co., near St. Johns, *C. Hope 9335* (C). Cochise Co., 5 miles w. of Benson, *R. C. Foster & J. F. Arnold 185* (G); Douglas, *Leslie N. Goodding 2262* (C); near Douglas, *Goodding 2235* (G); Ft. Huachuca, *Dr. T. E. Wilcox*, April, May, and August, 1894 (C; 3 collections), *Dr. E. Palmer 436* in 1890 (G); Lowell, *W. F. Parish 100* (G). Coconino Co., Cameron, *Herbert C. Hanson A54* (T); vicinity of Flagstaff, *Dr. D. T. MacDougal 43* (C, G); 14 miles w. of Navajo Bridge, *K. M. Wiegand & M. C. Wiegand 2363* (G). Gila Co., near Rock and Rye Creeks, *Mrs. Rose E. Collom 78* (G) apparently the same without number, dated May 1, 1938, USNA); near Rock Creek, *Collom 485* (C). Mohave Co., between Hackberry and Peach Springs, *Susan Delano McKelvey 2264* (G); Peach Springs, *Norman C. Wilson*, May 4, 1893 (C). Navajo Co., Holbrook, *Ivar Tidestrom 12788* (C, USNA). Pima Co., Santa Catalina

Mts., *Mr. & Mrs. J. G. Lemmon 117* (C). Pinal Co., Oracle Junction, *R. H. Peebles 6840* (USNA). Santa Cruz Co., Crittenden, *T. S. Brandegee*, May 25, 1892 (C); Nogales, *Brandegee*, May, 1892 (C); n. of Sonoito, *Foster & Arnold 149* (G); s. of Tubac, *J. H. Ehlers & Lois S. Ehlers 7246* (USNA). Yavapai Co., Ash Fork, *Henry H. Rusby 688* (C); Clemenceau, *Wyatt W. Jones*, April 7, 1921 (C); n. of Humboldt, *Tidestrom 12701* (USNA); Prescott, *Aven Nelson 10260* (G). CALIFORNIA: San Bernardino Co., Barnwell, *Katherine Brandegee*, May, 1911 (C); 5 miles s. of Barnwell, *P. A. Munz 13709* (C); New York Mts. near Leastalk, *S. B. Parish 10321* (G); Fourth of July Canyon, New York Mts., *Annie M. Alexander & Louise Kellogg 1310* (C, G). COLORADO: Archuleta Co., Arboles, *C. F. Baker 693* (C, G); Pagosa Springs, *E. Bethel, E. S. Willey & I. W. Clokey*, June 29, 1921 (C-Cl). Chaffee Co., Salida, *C. F. Baker, F. S. Earle & S. M. Tracy 17* (C, C-Cl, G). Fremont Co., Canon City, *T. S. Brandegee 552* (C). Garfield Co., Glenwood Springs, *Mrs. Wislizenus*, Aug., 1892 (G). Jefferson Co., 1 mile w. of Leyden, *A. A. Beetle 2083* (G). Mesa Co., Grand Junction, *C. S. Crandall*, May 28, 1894 (C). Montrose Co., Cimarron, *Baker 273* (C, G); Naturita, *E. Payson 283* (G). Ouray Co., Ridgway, *E. B. Payson & Lois B. Payson 3848* (G). Pueblo Co., Pueblo, *R. W. Woodward*, Oct., 1882, and May 25, 1883 (G). Saguache Co., w. of Villagrove, *Francis Ramaley & K. Richard Johnson*, July 9, 1935 (T). KANSAS: Ellis Co., Ellis, *Dr. L. Watson*, in 1874 (G). Lane Co., 4 miles n. of Healy, *Earl Bondy 552* (G). Logan Co., without locality, *A. S. Hitchcock, Pl. of Kans. 240* (G). Norton Co., Almena, *Rev. J. M. Bates 4550* (G). Osborne Co., within 5 miles of Osborne City, *C. L. Shear 24* (C, G). NEBRASKA: Franklin Co., Franklin, *H. Hapeman*, May 27, 1938 (USNA). NEVADA: Clark Co., Kyle Canyon, Charleston Mts., *Clokey 7738* (*Pl. Exs. Gray. 785*, as *Aster hirtifolius* Blake) (C, C-Cl, G, SMU, USNA); Kyle Canyon at junction with Deer Creek Road, *Clokey 7347* (C, G); below Wheeler Wells, *Clokey 7348* (USNA); Hidden Forest, Sheep Mts., *Alexander & Kellogg 1555* (C, G); Mormon Wells, Sheep Mts., *S. G. Jewett 160* (USNA); Timber Mt., 15 miles n.w. of Searchlight, *Percy Train 1475* (USNA); Searchlight, *J. Stirling* (C); Trout Canyon, 20 miles n.n.e. of Stump Springs, Pahrump Valley, Clark Co.-Nye Co., *I. LaRivers & N. F. Hancock 416* (USNA). Esmeralda Co., Gold Mts., *Purpus 5945* (C; densely strigose form); Palmetto Range, *Purpus 5906* (type of *Aster bellus* Blake, US; isotype, C; densely strigose form). Eureka Co., Italian Creek, Eureka, *Train*, June 14, 1936 (USNA). White Pine Co., 2 miles e. of Lehman Cave, *Bassett Maguire & R. J. Becraft 2838* (C; same, labeled "Baker to Lehman Cave," G); 3 miles s. of Ruth, *B. O. Moore & G. E. Franklin 347* (USNA). NEW MEXICO: Bernalillo Co., near Albuquerque, *E. J. Palmer 31174* (G); 2 miles e. of Albuquerque, *Dr. Alfred L. Kammerer 50* (T). Chaves Co., 5 miles e. of Roswell, *N. A. Palmer 25* (USNA). DeBaca Co., $10\frac{2}{3}$ miles n.e. of Dunlap, *V. L. Cory 37591* (G). Dona Ana Co., Organ Mt. Watershed, w. slope, *L. D. Love*, April 7, 1936 (USNA). Eddy Co., Carlsbad, *Cory*, April, 1924, and April 25, 1925 (TAM); Carlsbad Caverns National Park, *Perry Conris 6* (USNA). Grant Co., Bear Mt., 5 miles from Silver City, *Carl B. Wolf 2626* (G); Mangas Springs, 18 miles n.w. of Silver City, *O. B. Metcalfe 1468* (G); Silver City, *W. W. Eggleston 16432* (G); Santa Rita Mt., s. end of the Black Range, *Metcalfe 1468* (G); 2 miles e. of Separ, *Simon E. Wolff 1717* (TAM). Guadalupe Co., Santa Rosa, *Eula Whitehouse*, Sept. 3, 1929 (T); Vaughn, *Lewis S. Rose*, July 28, 1919 (C). Hidalgo Co., near Antelope Station, *M. W. Talbot 1210* (USNA). Lincoln Co., Gray, *Josephine Skehan 4* (C, G),

S. F. Earle & Esther S. Earle 156 (C). McKinley Co., 2 miles w. of Mexican Springs, *H. J. Helm 2* (USNA); near Klag-e-toh, Navajo Reservation, long. 109°15′ lat. 35°45′, *C. P. Starr 15* (USNA). Rio Arriba Co., 1½ miles n.w. of Conjilon, *Wolf 2937* (G); vicinity of Lake Burford, *A. Wetmore 493* (G). San Miguel Co., 2 miles w. of Las Vegas, *Francis Drouet & Donald Richards 3228* (G); Las Vegas-Hot Springs, *W. C. Sturgis*, May 5, 1902 (G); near Pecos, *P. C. Standley 4898* (G). Santa Fe Co., Santa Fe, *J. T. Rothrock 14* (G). Socorro Co., Mogollon Mts., on Mogollon Creek, *Metcalfe 324* (G). Torrance Co., without locality, *F. C. Werkenthin*, June 7, 1916 (T). Valencia Co., 7 miles n. of Trechado, *Hugh C. Cutler 2089* (G). OKLAHOMA: Beaver Co., 15 miles s.w. of Beaver City, *G. W. Stevens 361* (G); 5 miles w. of Gate, *G. J. Goodman 2399* (G); near Knowles, *Stevens 346.1* (G). Beckham Co., Sayre, *Delzie Demaree 12447* (G). Blaine Co., 8 miles s. of Watonga, *Goodman 2383* (G). Cimarron Co., 17 miles w. of Boise City, *U. T. Waterfall 3142* (G); near Kenton, *Stevens 480* (G). Ellis Co., near Shattuck, *R. L. Clifton, 3125, 3166½* (G). Harmon Co., near Hollis, *Stevens 1053, 1165½* (G). Harper Co., near Hornbeck's, *Stevens 257* (G). Major Co., near Waynoka, *Stevens 607* (G). Texas Co., near Camp, *Stevens 398, 406½* (G); n. of Guymon, *Quentin Williams 13* (T). Woods Co., near Cora, *Stevens 222* (G). TEXAS: Armstrong Co., 3½ miles s. of Claude, *L. H. Shinners 8116* (SMU). Brewster Co., Alpine, *Barton H. Warnock*, March 3, 1938, and Aug. 18, 1938 (T); 55.4 miles s. of Alpine, *H. B. Parks & V. L. Cory 18633* (TAM); Green Valley, Glass Mts., *Warnock 270* (T); Chisos Mts., *C. H. Mueller 8196* (G; apparently the same, without number, T); 19 miles e. of Marathon, *C. L. Lundell & Amelia A. Lundell 14207* (SMU). Briscoe Co., Quitaque, *B. C. Tharp*, April 28, 1934 (T). Carson Co., 5 miles n. of Panhandle, *Shinners 8112* (SMU). Concho Co., Concho, *J. Reverchon, Curtiss's N. Amer. Pl. 1241* (G; isotype of *Leucelene alsinoides* Greene). Crane Co., 6 miles s. of Crane, *Tharp*, July 11, 1941 (T). Culberson Co., foothills of the Guadalupes, 5 miles n.e. of Pine Springs, *Waterfall 5273* (G); 1 mile n. of Kent, *W. B. Davis. Lint Robertson, & L. A. Smith 14* (TAM); 9 miles e. of Van Horn, *Waterfall 4014, 5336*, (G), 8 miles n. of Van Horn, *Waterfall 4074* (G); 18½ miles s.w. of Van Horn, *Cory 44077* (T). Dallam Co., 7 miles n.w. of Dalhart, *Shinners 8174* (SMU). Donley Co., 8 miles s. of Clarendon, *F. A. McArty*, April 27, 1944 (T); Jericho, *Demaree 12435* (T). Edwards Co., Texas A. & M. Substation 14 (s. of Sonora, Sutton Co.) *Cory 37072, 39026* (G), *48753* (SMU). El Paso Co., El Paso, *Geo. Thurber 189* (G), *Whitehouse*, April 13, 1932 (T); Frontera near El Paso, *Charles Wright*, April 1, 1852 (SMU); Hueco Mts., *Whitehouse*, March 27, 1932 (T). Hansford Co., 5 miles s.e. of Gruver, *Shinners 8228* (SMU). Hartley Co., 15 miles s.e. of Dalhart, *Shinners 8166* (SMU). Hemphill Co., 5 miles s. of Canadian, *Shinners 8277* (SMU). Hudspeth Co., e. side of Eagle Mts. 6½ miles s. and 1½ miles w. of Hot Wells, *Waterfall 4953* (G); Eagle Springs near Sierra Blanca, *Whitehouse*, April 22, 1932 (T); 3 miles e. of Sierra Blanca, *Waterfall 4953* (G). Hutchinson Co., 2 miles s. of Borger, *Shinners 8096* (SMU). Jeff Davis Co., Davis Mts., *M. S. Young*, Aug. 20, 1914 (T); Goat Canyon, Mt. Livermore, Davis Mts., *L. C. Hinckley*, Aug. 22, 1935 (T); Ft. Davis, *Whitehouse*, April 20, 1932 (T); White Rose Pass, Davis Mts., *Cory 18906* (USNA; the local name for this place is Wild Rose Pass). Lubbock Co., 5 miles e. of Idalou, *Shinners 8359* (SMU); Lubbock, *Demaree 7514* (G), *Tharp*, Sept. 2, 1929 (C-Cl, T); Landrew's Ranch, Lubbock, *Demaree 7683* (G); Slaton, *Whitehouse 10523* (SMU). Midland Co., Midland, *Parks & Cory 12494* (TAM). Mitchell

Co., 2 miles n.w. of Colorado City, *Shinners 8415* (SMU); Renderbrook Pasture, Spade Ranch (sw. ¼ sec. 28, Lavaca Nav. Co. Block 19), *Richard W. Pohl 4482* (SMU). Moore Co., 13 miles s. of Dumas, *Shinners 8144* (SMU). Nolan Co., Sweetwater, *Mrs. V. E. Stanfeld*, March 22, 1928 (T). Ochiltree Co., 8 miles s.s.e. of Perryton, *Shinners 8254* (SMU). Oldham Co., w. of Adrian, *Lundell & Lundell 11464* (SMU); 4 miles n.w. of Magenta, *Shinners 8162* (SMU); 3 miles n. of Vega, *M. W. Howard 15* (USNA). Pecos Co., 2.2 miles w. of Longfellow, *Parks & Cory 18633* (TAM, USNA); 9 miles w. of Ft. Stockton, *Lundell & Lundell 10195* (SMU); 21 miles e. of Ft. Stockton, *Cory 40308* (G, T); Pecos to Ft. Stockton on Highway 285, about 15 miles from Ft. Stockton, *Whitehouse 10531* (SMU). Potter Co., 16 miles n. of Amarillo, *Goodman 2445* (C, G.); 15 miles n.e. of Amarillo, *Shinners 8049* (SMU). Presidio Co., 11½ miles s.e. of Casa Piedras, *Parks & Cory 26408* (TAM, USNA); between head of McComb's and Musgrave Canyon, Tierra Vieja Mts., *Hinckley 2066* (SMU; apparently the same, without number, T); Shafter, *Hanson 629* (G). Randall Co., branch of Palo Duro Canyon, *Young*, Sept. 4, 1917 (T); 10½ miles e. of Canyon, *Parks & Cory 13541* (TAM); 12½ miles e. of Canyon, *Shinners 8042* (SMU). Reagan Co., Big Lake, *Parks & Cory 18943* (TAM). Reeves Co., w. of Pecos, *Tracy & Earle 103* (G, T). Scurry Co., Roscoe to Snyder, *Whitehouse 10220* (SMU). Sherman Co., 25 miles e. of Stratford, *Shinners 8209* (SMU). Sterling Co., Gasconade Creek, sec. 32, SPRR Block 15, *Pohl 4792* (SMU). Taylor Co., Camp Barkeley, *W. L. Tolstead 6963* (C; without number, G), March 20, 1943 (G). Upton Co., 8 miles e. of Rankin, *Tharp*, July 11, 1941 (G, SMU, T). Ward Co., 10½ miles s. of Monahans, *Cory 27333* (USNA). Wichita Co., 7½ miles s.w. of Iowa Park, *Parks & Cory 13251* (TAM, USNA); 6.7 miles w. of Kadane Corners, under mesquite, *Whitehouse 9692* (SMU), same locality, along roadway, "looked slightly different," *Whitehouse 9695* (SMU). UTAH: Carbon Co., Price, *Susan G. Stokes*, June 20, 1898 (C); 8 miles n. of Wellington, *Maguire 18569* (G). Daggett Co., Grouse (Summit) Creek Canyon (Jackson Draw), Uinta Basin, *Edward H. Graham 8114* (C-Cl, G, USNA). Emery Co., San Raphael River, *B. F. Harrison 8065* (C). Garfield Co., Bryce Canyon, *F. A. Thackeray 559* (C-Cl, USNA); Panguitch, *Eggleston 8125* (USNA). Grand Co., above Mill Creek, La Sal Mts., *Bassett Maguire & B. L. Richards Jr. 15722* (G). Iron Co., 1 mile n. of Bear Creek, Dixie National Forest, *Grazing Reconnaissance Crew*, June 24, 1936 (C); Modena, *Goodding 999* (G). Juab Co., base of mountains e. of Nephi, *J. Arthur Harris 261* (G). Kane Co., near Willow Tank, *Harrison 9115* (USNA). Salt Lake Co., near Bingham Canyon, *A. O. Garrett 2275* (G); Ft. Douglas, *Mrs. J. Clemens*, July 21, 1911 (C-Cl); Salt Lake City, *Garrett 8591* (SMU). San Juan Co., 9 miles n.w. of Blanding, *Bassett Maguire & J. D. Redd 2164* (C); 1 mile w. of Lockerby, *Cutler 2739* (G); e. of Monticello, *P. A. Rydberg & A. O. Garrett 9197* (C). Uinta Co., Red Wash just n.w. of mouth of Split Canyon, above Island Park, *Graham 9163* (G, USNA). Washington Co., St. George, *Goodding 782* (G); Springdale, *M. E. Jones*, May 14, 1894 (C). Wayne Co., w. of Fruita, Capitol Reef National Monument, *Annetta Carter 1543* (C); Natural Bridge near Fruita, *Harrison 7379* (USNA).

Also reported from Wyoming by Aven Nelson in Coulter and Nelson's New Manual of Rocky Mountain Botany, p. 522, 1909, with the observation that the genus is "essentially monotypic." The following two type col-

lections have also been examined, but for want of adequate or reliable data have not been cited above:

NEW MEXICO: without locality, *A. Fendler 348* (type of *Diplopappus ericoides* var. *hiretella* A. Gray, G; isotype, C; in the original description only one number is cited, but the plant is said to grow "on sides of ravines in arid places, Santa Fe; also on the Rio del Norte; May, June"). Without locality, *Wright 1171* (type of *Aster ericaefolius* var. *tenuis* A. Gray, G; isotype, C; fragments, mounted with other fragmentary collections).

EXCLUDED SPECIES

Leucelene alpina (Nutt.) Greene, Fl. Franciscana pt. 4: 384. 1897. = *Ionactis alpina* (Nutt.) Greene, Pittonia 3: 245. 1897. (Also known as *Aster scopulorum* A. Gray.)

THE GENUS DICHAETOPHORA A. GRAY AND ITS RELATIONSHIPS

LLOYD H. SHINNERS

INTRODUCTION

As has already been noted under *Chaetopappa* and *Leucelene*, the nature of the pappus does not offer a very reliable clue to the relationships of many genera of the COMPOSITAE. Among the heterochromous ASTEREAE, a somewhat better, though still imperfect, arrangement of the indigenous genera may be made according to the form of the receptacle. In *Boltonia*, *Dichaetophora*, *Astranthium*, *Aphanostephus*, *Egletes*, and some species of *Erigeron*, the receptacle is hemispherical to conical, instead of flat or merely slightly convex. This sets off a somewhat miscellaneous group of genera which, though not all obviously closely related, at least do not show closer affinities elsewhere in the tribe, except for the species of *Erigeron*, and perhaps *Boltonia*. A further small but possibly significant point of resemblance among them lies in the manner of wilting of the rays, which remain extended or twist irregularly in withering, or are quickly deciduous, without coiling. In *Chaetopappa*, *Leucelene*, *Aster*, *Machaeranthera*, *Sideranthus*, *Isopappus*, *Chrysopsis*, and probably a majority of the ASTEREAE, the rays curl under from tip toward base, unless they are extremely short or have not first become fully expanded. The heads will often appear discoid when beginning to go to seed, the curled rays having become quite inconspicuous.

Dichaetophora was placed under *Boltonia* by Bentham and Hooker, chiefly because of the flattened, broadly winged, ribless achenes with pappus of squamellate awns, nearly identical in the two genera. In many other significant points, *Dichaetophora* is closer to *Astranthium*, showing particular resemblance to *A. integrifolium* (Michx.) Nutt. In *Boltonia*, the phyllaries are unequal, imbricated in 3–6 series, somewhat coriaceous except on the margin, with prominent and sometimes almost keel-like midvein; the involucre is narrowed and more or less pointed at base; the disk corollas are not very abruptly contracted to form the tube; the pubescence of the achenes is not glandular; and the plants are typically rather tall, much-branched perennials. In *Dichaetophora campestris* and *Astranthium integrifolium*, the phyllaries are equal in about 2–3 series, rather thin and flat; the involucre is broad and shallow; the disk corollas are very abruptly contracted to form a short basal tube, and abruptly enlarged at the attachment to the achene;[1] the achenes bear peculiar gland-tipped hairs;

[1] This is so indistinctly shown in Miss Larsen's figure (*pl. 2, fig. 9*) as to be rather misleading. Her sketch of a ray floret (*fig. 8*) shows it with the type of style found only in the disk florets.

and the plants are low annuals, with solitary heads terminating long naked peduncles. The ribless achene of *Astranthium* is not winged, but the vestigial squamellate pappus forms a small elliptic ring in the middle of the summit, reminiscent of *Dichaetophora*.

There is remarkable mimicry in superficial appearance between small plants of *Dichaetophora* and *Astranthium*, and small plants of some species of *Aphanostephus*. But *Aphanostephus* is set off by a number of marked differences in detail. The phyllaries are unequal and imbricated in about 3–4 series; the tube of the disk corollas is peculiarly thickened or swollen below the middle or at base; the achenes are columnar and truncate at both ends or cupped at summit, with incomplete superficial ridges, though not true ribs; the pappus forms a ring around the whole broad summit of the achene, and the pubescence of the achene, if present, is not glandular. An often useful means of distinguishing young plants is the direction of the pubescence on the peduncles. In *Aphanostephus* it is horizontally spreading to downwardly appressed; in the other two it is widely spreading, ascending, or upwardly appressed. The species of *Aphanostephus* are low annuals or perennials, with broad shallow involucres, and outer phyllaries a third to three-fourths as long as the inner, unlike the narrower pointed involucre with very short outermost phyllaries found in *Boltonia*, and the achenes of the two genera, as already described, are quite dissimilar.

In *Erigeron tenuis* T. & G., the receptacle is occasionally so strongly convex as to appear nearly conical in age, forming a transition to several species of west Texas and Mexico having a decidedly conical receptacle. There is an independent series of variations in pappus, from the wholly capillary simple one of *E. philadelphicus* L., through the capillary double pappus of *E. pumilus* Nutt., or the partly squamellate double pappus of *E. Bigelovii* A. Gray and *E. coronarius* Greene, to the wholly squamellate pappus of those species (mostly with flat or merely convex receptacle) placed under *Achaetogeron*, and including forms in which the pappus is quickly deciduous or even quite wanting. In all of them the phyllaries are uniformly very narrow and all of similar shape, in 2 or 3 equal series, or an outer row of equal phyllaries only slightly shorter than the inner; the rays are numerous, narrow (sometimes also very short), and in 2–3 series (except in a few species with flat or convex receptacle); and the achenes have 2 or more true ribs, prominent from base to summit.

The genus *Egletes* is characterized by a conical receptacle, like that of *Boltonia*, *Dichaetophora*, *Astranthium*, and *Aphanostephus*, and achenes with true ribs, like those of *Erigeron*. In most other respects, it shows relatively little resemblance to any of these genera. The phyllaries are broad, unequal, usually without distinct midvein, in several series, forming an involucre greatly resembling that of *Pluchea* in the INULEAE-PLUCHEINAE. There is further resemblance in the multiseriate reduced marginal pistillate florets of most of the species, suggesting what one might expect to have been an ancestral form of the head of *Pluchea*, in which only a few central florets are perfect and well developed, the more numerous marginal pistil-

late ones having very reduced filiform corollas. The frequent presence of viscous or glandular hairs, and the largely tropical distribution of both genera, also suggest possible relationship.

The following key will outline the more important differences between the indigenous North American genera of heterochromous ASTEREAE having a hemispherical or conical receptacle.

1. Achenes with true ribs extending from base to summit; marginal pistillate corollas (often very reduced) in 2 to many series.....2.
   2. Phyllaries broad (lanceolate to oval), usually without definite midvein unless toward the base, unequal, in 3–5 series; vegetative parts often viscid or glandular and aromatic; chiefly tropical plants of lowlands, South America north to Mexico and Texas (lower Rio Grande) and in the West Indies.....*Egletes*.
   2. Phyllaries narrow (rather narrowly lanceolate to lance-linear), the midvein usually distinct from base to tip, in 2 or 3 equal series, or an outer row of equal phyllaries slightly shorter than the inner; vegetative parts not viscid or glandular and aromatic; chiefly temperate zone plants, the Mexican species montane, with a few exceptions.....*Erigeron* (in part).
1. Achenes without true ribs, at most with incomplete superficial ridges; marginal pistillate corollas in 1–2 series, conspicuously radiate.....3.
   3. Achenes columnar, quadrate or terete, truncate at both ends or cupped at summit; pappus forming a ring around the whole broad summit of the achene; pubescence of peduncles horizontally spreading or reflexed, never upwardly appressed.....*Aphanostephus*.
3. Achenes more or less flattened, broader than thick; pappus in a small elliptic ring in the center of the narrowed summit of the achene; pubescence of peduncles widely spreading to upwardly appressed, never reflexed.....4.
   4. Phyllaries equal, in 2–3 series.....5.
      5. Achenes not winged; pappus very short or obsolete.....*Astranthium*.
      5. Achenes winged; pappus of two prominent squamellate awns and several very small ones.....*Dichaetophora*.
   4. Phyllaries unequal, imbricated in about 3–6 series, the outermost at maturity not more than a third as long as the innermost.....*Boltonia*.

SYSTEMATIC TREATMENT

DICHAETOPHORA A. Gray, Plantae Fendlerianae (Mem. Amer. Acad. n.s. 4): 73-74. 1849.

Boltonia sect. *Dichaetophora* (A. Gray) Bentham & Hooker, Gen. Plant. 2: 269. 1873.

Annual from a slender taproot. Stems usually several or many, suberect or decumbent at base, 4–24 cm. tall, simple or sparingly forked, terminating in long peduncles naked for 2–9 cm. below the heads when in full flower or fruit; sparsely to rather densely pubescent with spreading, as-

cending, or upwardly appressed hairs. Basal leaves (often withering before the plant has finished flowering) oblanceolate, obtuse, entire; the blades 1.0–2.3 cm. long, 4–12 mm. wide, the narrow petiolar base 0.6–2.3 cm. long. Stem leaves alternate, similar to the basal ones but smaller, the upper gradually reduced, the uppermost bract-like ones narrowly oblong or lance-linear, 4–16 mm. long, 1.0–2.5 mm. wide.

Heads solitary and terminal on the stems or branches. Involucres 3.0–4.5 mm. high, broadly campanulate to saucer-shaped; phyllaries in two series, equal, lanceolate, acute, about 0.6–1.2 mm. wide; thinly chartaceous or membranaceous, green except for the scarious margin, sparsely and somewhat hispidly appressed pubescent on the back, serrulate-ciliate on the margins and weakly spine-tipped. Receptacle conical to subglobose, naked, glabrous, slightly pitted and roughened by the points of attachment of the achenes. Heads heterogamous and heterochromous. Ray florets about 16–24, uniseriate, pistillate, fertile, ligulate; ligules white, rarely lilac-tinged, especially on the back, 5–9 mm. long; tube about 0.5 mm. long; style branches flattened, linear, obtuse, 0.4 mm. long. Disk florets hermaphrodite, fertile; corollas yellow, tubular, about 2.5 mm. long, abruptly constricted just above the flared and slightly thickened base to form a very short tube about 0.2 mm. long, the cylindric-campanulate limb (making up most of the corolla) equally 5-lobed at summit, the lobes about 0.6 mm. long. Style branches flattened, 0.6 mm. long, tipped by a narrowly acute, dorsally granular-scabrous appendage making up a third of the total length. Anthers rounded at base, tipped by a narrowly acute hyaline appendage about 0.25 mm. long.

Achenes appearing nearly flat, oval or orbicular in outline: the thickened center lanceolate in outline, densely pubescent with ascending, whitish, glandular-capitate hairs, surrounded by a broad coriaceous wing-margin equal in width to the central portion at either side, narrowed at top and bottom, glabrous on the faces, densely fringed with glandular-capitate hairs; total width of achene 1.6–2.0 mm. Pappus consisting of two antrorsely scabrous, erect or diverging, equal or slightly unequal awns 0.7–1.1 mm. long, near the middle of the truncate or slightly emarginate summit of the achene, usually with several additional minute ones 0.25 mm. or less long, forming an elliptical ring with the long awns on either end, at the wing-margins. Ciliation on the margins of the achene often longer toward the summit and simulating a supplementary pappus.

Small spring-flowering annuals (February-May, or stragglers occasionally later) of the Rio Grande Valley and tributaries in southern Texas and northern Mexico, growing in mesquite prairies, meadows, or other low, sandy or silty open ground.

Type and only species: *D. campestris* A. Gray.

To their *Boltonia* section *Dichaetophora*, Bentham and Hooker assigned three species, one not named and none formally transferred to *Boltonia*, two being mentioned simply as *Dichaetophora* Gray, and *Poly-*

actidium Seemannii Sch. Bip. Gray's genus was restored to its original form by him in the Synoptical Flora, where *Polyactidium* is listed as a synonym of *Erigeron*. From the description given by Bentham and Hooker of the unnamed species based on Coulter's no. 278 from California, and of *Polyactidium Seemannii* ("achaenia margine calloso-nerviformi," "achaenia nerviformi-marginata," and "statura elatior et ligulae numerosissimae *Erigerontis* sect. *Phaenactidis*"), both plants are evidently species of *Erigeron*.

DICHAETOPHORA CAMPESTRIS A. Gray, Pl. Fendl. (Mem. Amer. Acad. n.s. 4): 73–74. 1849.

Boltonia campestris (A. Gray) Benth. & Hook. ex Hemsley, Biol. Cent.-Amer. Bot. 2: 120. 1881.

Of the three Mexican collections of Dr. Josiah Gregg cited by Gray in the original description of *Dichaetophora campestris*, that from Bishop's Hill, near Monterey, Nuevo Leon, Feb. 6, 1847, has been selected as type (in Gray Herbarium, under number 48; an evident duplicate in the herbarium of the Missouri Botanical Garden, under number 135).

Additional specimens examined: CHIHUAHUA: valley of Rio Conchos, *Gregg 499*, April 21, 1847 (Mo; duplicate in Gray Herb. under number 10). (Gregg's diary of this date gives the locality as en route from Jimenez to Santa Rosalia, along the Rio Florida branch of the Conchos, 10 miles southeast of Santa Rosalia.) COAHUILA: Rio Grande Valley near Diaz, *C. G. Pringle 8303* (C, G, Mo). Muzquiz, *Ernest Marsh*, spring, 1935 (T; mixed with *Aphanostephus ramosissimus*). NUEVO LEON: Monterey, *Gregg 49* (G), *Dr. E. Palmer 501* in 1880 (G). Battlefield between Citadel and Teneria (Tenorio?), Monterey, *Gregg 134* (Mo). San Juan, *Pringle 13720* (G). TEXAS: Atascosa Co., near Campbellton, *Eula Whitehouse 10382* (SMU). Brooks Co., 4 miles s. of Falfurrias, *K. M. Wiegand & M. C. Wiegand 2432* (G). Frio Co., Dilley, *B. C. Tharp*, Feb. 27, 1930 (T); Devine-Dilley, *Tharp*, April 6, 1930 (T); 11 miles w. of Dilley, *L. H. Shinners 7411* (SMU). Jim Hogg Co., outside city limits of Hebbronville on Highway 59, *Whitehouse 10383* (SMU). Maverick Co., Eagle Pass, *V. Havard 16* (G), *H. C. Hanson 368* (G, Mo, T). Webb Co., Laredo, *J. Reverchon 4005* (Mo); near Bruni, *F. A. Warren 1187* (USNA).

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REVISION OF THE GENUS APHANOSTEPHUS DC.

LLOYD H. SHINNERS

INTRODUCTION

It is eloquent testimony of the confusing variations in the genus that *Aphanostephus* was described as three different genera by the same author almost simultaneously, and that one of its first known species was described under different names in two genera in two different tribes; yet every one of its eleven species, in one or another of its growth forms, has been or could easily be mistaken for one or several of the others. About its generic status, however, there need be little question. It possesses the flattened, triangular-appendaged style branches of the disk florets characteristic of the ASTEREAE; it does not have the cone-tipped style branches of the ANTHEMIDEAE, in which tribe De Candolle placed his synonymous genus *Leucopsidium*. As mentioned in connection with *Dichaetophora*, it belongs to the small group of heterochromous ASTEREAE having a conical or hemispherical receptacle. It differs strikingly from all the genera to which it shows other resemblances in having peculiar, ribless, columnar achenes. In superficial appearance it suggests *Erigeron* or *Astranthium*, but differs from them in having unequal phyllaries, as well as in the achenes. A minor characteristic, often helpful in assigning immature plants to the proper genus, is the widely spreading to downwardly appressed pubescence of the peduncles and stems. In the plants likely to be mistaken for it, excepting a few species of *Erigeron*, the pubescence varies from spreading to upwardly appressed.

As in a number of other genera of the Southwest and Mexico, the species exhibit much ecological and especially seasonal polymorphy, while detailed technical differences show close convergence or overlap. Comparisons must be made only between properly comparable forms. Casual examination of an assortment of herbarium specimens assigned to several species may give the impression that an incoherent jumble has been divided at random into several equally incoherent jumbles, with no distinctions that hold good. *Aphanostephus skirrhobasis* (DC.) Trel., in normal spring form, at a stage when the earliest heads to flower have started to go to seed, is readily separable from equivalent plants of *A. arizonicus* A. Gray by the larger involucres, uneven pappus, and hardened, inflated corolla bases. But less mature plants, with slightly smaller involucres, less distinct pappus, and corolla bases not yet hardened or inflated, may easily be misnamed; so also might partly developed late-season plants, which produce secondary branchlets with smaller heads than those of the spring form. Very dwarf, unbranched, single-headed, early spring plants of the two species show

scarcely any pronounced differences in detail, and are closely similar in general appearance. *A. arizonicus* and *A. ramosissimus* DC. often, and other northern species less frequently, show signs of injury like that of grasses in which an insect larva has eaten through the culm inside an upper leaf sheath, causing the inflorescence to turn brown and wither before it has fully expanded. In plants of *Aphanostephus*, many of the involucres take on an ovoid shape, remain closed, and turn brown and dry, together with part of their peduncles. This abnormality seems to develop only in late spring and summer, and is especially frequent and striking on much branched plants with numerous heads. Specimens of such abnormal plants belonging to two or three different species, laid side by side, will seem very much alike; and if no fully mature normal heads are present, it will be hard to find any convincing grounds for calling them more than one species. As a further complication, it is most probable that crossing takes place between species. All of them usually occur in abundance, and several may grow together; they prefer eroding ground, blowouts, roadsides, and other disturbed places, which in such genera as *Aster* and *Solidago* are known to be especially favorable to the appearance of hybrids. Specimens have been collected, or found in herbarium material, which from appearance, locality of collection, and (when known) associated species, suggested crosses between *Aphanostephus arizonicus* and *A. humilis* (Benth.) A. Gray, *A. arizonicus* and *A. skirrhobasis*, *A. Kidderi* Blake and *A. ramosissimus*, and *A. ramosissimus* and *A. skirrhobasis*. Most unfortunately for the taxonomist, intermediates between *A. ramosissimus* and *A. skirrhobasis* are very hard to distinguish from *A. arizonicus*, except by geography. Both supposed parents are abundant and widespread, and in west-central Texas, where their ranges meet or overlap that of *A. arizonicus*, the number of plants of uncertain identity is especially high.

An abundance of material and field observation have made it possible to untangle many of the perplexing variations in the United States, and treat them taxonomically with some assurance. Much less assurance is felt with regard to the more numerous species of Mexico. They evidently vary greatly with relation to the rainy season, which may come at different times in different parts of the country, so that calendar date by itself is not the simple and helpful clue that it is farther north. A majority of them apparently tend to be coarser and stouter than the northern species; at least, a good many specimens show only basal branches from what must have been a quite large and bushy plant, but there is no information as to habit or root system. A discouragingly large number of collections show out-of-season shoots from the bases of old plants, never very satisfactory for exact determination, and offering little but unalloyed difficulty, especially when accompanied by no information about habitat or about the plant itself. The untangling of the variations among the Mexican species has been fraught with much uncertainty, and has depended a great deal upon analogy with what is better known of the species of the United States. It has been found impossible to construct a simple dichotomous key on the

basis of available material; a synopsis in quasi-key form is offered as substitute.

SYSTEMATIC TREATMENT

APHANOSTEPHUS DC., Prodromus 5: 310. 1836.

Keerlia DC., Prodr. 5: 309–310. 1836. [This genus merged with *Aphanostephus* under the latter name by Asa Gray, Plantae Wrightianae Part I (Smithsonian Contr. vol. 3 art. 5): 93, 1852, and Proc. Amer. Acad. 16:81–82, 1880.]

Leucopsidium DC., Prodr. 6: 43. 1837.

Aphanostephus subg. *Euaphanostephus* Blake, Contr. Gray Herb. 53: 24. 1918. (Dr. Blake's second subgenus is retained as Section 1, below.)

Annuals or perennials from taproots, or perennials forming clumps from vertical, ultimately obliquely branched, woody caudices. Leaves alternate, simple, entire to deeply pinnatifid, sessile or petioled, in a few species more or less clasping at base. Heads solitary and terminal on the branchlets; peduncles with widely spreading to downwardly appressed, but never with ascending or upwardly appressed hairs. Involucre saucer-shaped to broadly hemispherical or (especially in fruit) broadly urn-shaped; of narrowly lanceolate to oblong-oblanceolate, broadly acute to acuminate, chartaceous, scarious-margined phyllaries imbricated in about 3–5 series, the outermost about $\frac{1}{3}$–$\frac{3}{4}$ as long as the innermost. Receptacle depressed-hemispherical to conical, naked, roughened by the raised points of attachment of the achenes. Heads heterogamous, radiate, heterochromous, many-flowered. Rays uniseriate or sub-biseriate, pistillate, fertile, ligulate; ligules lance-linear or lance-oblong to elliptic, slightly emarginate or denticulate at the narrowed apex, white to lavender or rose-purple (most commonly white within, partly or wholly colored without), persistent, in drying becoming inrolled sideways or longitudinally furrowed, remaining extended instead of coiling from tip toward base; tube short; style branches linear or lance-linear, obtuse or subacute. Disk florets hermaphrodite, fertile; corollas yellow, tubular, narrowly funnel-form or with more or less distinct cylindric basal tube and urn-shaped limb, equally 5-lobed at summit; base of tube in some species with thickened or hardened walls, becoming slightly to greatly enlarged in fruit; style branches flattened, tipped with a short, broadly triangular, acute appendage; anthers obtuse at base, tipped with an acute, hyaline but centrally or basally thickened appendage. Achenes of disk and ray similar, columnar, subterete to quadrate, slightly expanded toward the summit, often curved (peculiarities of growth due to pressure on the conical or rounded receptacle), glabrous or sparsely pubescent, with 4–12 distinct to very obscure grooves or superficial ridges not differing from the rest of the achene surface in texture and usually not extending completely from base to summit (immature achenes may appear strongly ribbed longitudinally as a result of shrinkage in drying). Pappus an uneven scaly crown around the periphery of the broad summit of the achene, ciliate or the lobes sharp-pointed or prolonged into narrow awn tips, in all 0.25–1.8 mm. long; or pappus a

rather minute crown of equal hairs or ciliae 0.1–0.25 mm. long. Pappus similar in disk and ray, or that of the ray shorter.

Type species: *A. ramosissimus* DC.

OUTLINE OF THE MEXICAN SPECIES OF APHANOSTEPHUS[1]

1. Rays 40–65 or more; plant a clump-forming perennial, the woody caudex becoming much branched, the divisions oblique or almost creeping; hairs of the peduncles rather coarse, hispid, from swollen bases, widely spreading, 0.2–0.6 mm. long; lower leaves toothed to deeply pinnatifid, passing rather abruptly into the narrowly oblanceolate or lance-oblong to linear, entire middle and upper ones; plants of extreme northeastern Mexico (Nuevo Leon, Coahuila) ..... 11. *A. Riddellii.*

1. Rays 16–42; plant annual or perennial from a taproot; hairs of the peduncles relatively fine and soft, from slightly swollen bases, widely spreading to downwardly appressed, 0.2–1.0 mm. long; lower leaves toothed to deeply pinnatifid, passing gradually into the smaller, less divided middle and upper ones ..... 2.

2. Middle phyllaries 0.6–1.1 mm. wide; phyllaries all with uniformly very narrow dark centers; achenes about 1.0–1.4 mm. long; rays 5.0–7.5 mm. long (see also key to U. S. species below for further differences between *A. ramosissimus* and *A. arizonicus*) ..... 3.

3. Rays 30–40; involucres 4.5–7.0 mm. high; plants of San Luis Potosi ..... 4. *A. potosinus.*

3. Rays 16–32; involucres 3.6–5.0 mm. high; plants of Tamaulipas and Nuevo Leon ..... 5. *A. ramosissimus.*

2. Middle phyllaries 1.1–2.0 mm. wide; dark centers of the phyllaries varying greatly from very narrow in the innermost to broad in the middle and outer; achenes about 1.3–2.0 mm. long; rays 6–9 mm. long (the following five species could not be fitted into a dichotomous outline) ..... 4.

4a. Plants of northern Mexico (Chihuahua, Coahuila; doubtfully Durango and Zacatecas), stems normally erect or ascending, at first simple, ultimately much branched; peduncles naked for 1.5–8.0 cm.; hairs of peduncles widely spreading or slightly deflexed, 0.3–1.0 mm. long; uppermost leaves moderately to not at all clasping, 0.5–1.5 cm. long; disk corollas 1.8–2.5 mm. long; achenes about 1.5 mm. long ..... 6. *A. arizonicus.*

4b. Plants of north-central Mexico (Durango to Guanajuato, doubtfully to Hidalgo); stems or main branches usually decumbent to ascending, usually not much branched except as a result of injury; peduncles naked for 0.3–3.5 cm.; hairs of peduncles 0.2–0.5 mm. long, widely spreading to downwardly appressed; uppermost leaves more or less clasping, 0.2–0.8 cm. long; disk corollas 2.6–3.0 mm. long; achenes 1.3–1.5 mm. long ..... 7. *A. humilis.*

4c. Plants of southwestern and possibly central Mexico (Jalisco, doubtfully east to Queretaro); stems normally erect from curved bases, sparingly branched, the branches rather closely as-

[1]Excepting *A. skirrhobasis* var. *thalassius* Shinners, coast of northeastern Tamaulipas.

cending; peduncles naked for 2.0–7.5 cm.; hairs of peduncles 0.3–0.8 mm. long, widely spreading to slightly deflexed; uppermost leaves with slightly broadened, rounded, clasping bases, 0.7–2.0 cm. long; disk corollas about 2.9 mm. long; achenes 1.6–2.0 mm. long. . . . . 8. *A. jaliscensis.*

4d. Plants of southwestern and south-central Mexico (Michoacan to Mexico State); stems ascending; peduncles naked for 1.5–5.5 cm.; hairs of peduncles usually rather sparse, 0.2–0.6 mm. long, deflexed to downwardly appressed; uppermost leaves more or less clasping, 0.6–1.5 cm. long; disk corollas about 2.8 mm. long; achenes about 1.5 mm. long; middle and inner phyllaries sharply acute to rather long-acuminate. . . . . 9. *A. ramosus.*

4e. Plants of south-central Mexico (Orizaba region of Vera Cruz, Puebla, Tlaxcala, Mexico State, Hidalgo); stems numerous, prostrate with ascending tips, simple or sparingly branched; peduncles naked for 2–5 cm.; hairs of peduncles 0.2–0.4 mm. long, widely spreading, deflexed, or downwardly subappressed, usually dense; uppermost leaves little or not at all clasping, 0.6–1.5 cm. long; disk corollas about 2.5 mm. long; achenes about 1.5 mm. long; middle and inner phyllaries rather broadly acute . . . . . 10. *A. pachyrrhizus.*

KEY TO THE UNITED STATES SPECIES OF APHANOSTEPHUS

This key is based chiefly on spring-flowering plants sufficiently advanced for the earliest heads to have begun to form seed. Very dwarf, precociously flowering, unbranched plants of early spring show scarcely any distinguishing characters. Plants which have passed into a second summer- or fall-flowering phase lack the lower leaves, usually have more numerous, smaller, fewer-flowered heads, with fewer, shorter rays The perennial *A. Riddellii* T. & G. commonly flowers twice, like *Leucelene ericoides* (Torr.) Greene, and is the one most likely to be collected in summer or fall.

1. Plant conspicuously hispid with coarse, jointed, translucent hairs, those of the stem and branches 0.7–2.2 mm. long (easily broken), spreading at right angles; heads somewhat crowded, the short peduncles naked for 3–12 mm., or in age for as much as 25 mm.; rays 12–18; plants of southwestern Oklahoma and adjacent Texas. . . . . 1. *A. pilosus.*

1. Plant soft-pubescent to hispid-pubescent, the hairs widely spreading to deflexed or downwardly subappressed, 0.2–1.0 mm. long; heads not crowded, the peduncles naked for 1.5–10.0 cm., or in age as much as 15 cm.; rays 16–65 or more. . . . . 2.

2. Pappus uneven and scaly, the scales variously lacerate-ciliate, acute, or prolonged into awn-like tips, in all 0.25–1.8 mm. long; corolla bases becoming whitened, hardened, and inflated in age to twice or more their original diameter. . . . . 3.

3. Involucres (of well-developed plants) 6.0–8.2 mm. high; phyllaries in about 4–5 series; rays about 8–15 mm. long, 1.5–2.3 mm.

wide; mature achenes about 1.5–2.2 mm. long; pappus an irregular scaly crown, or of about 5 unequal, acute scales 0.25–0.9 mm. long.....4.

4. Plants of the interior, Texas to New Mexico, Kansas, Missouri, and Arkansas; various in habit and pubescence, but pubescence of involucres rather coarse and hispid.....2a. *A. skirrhobasis.*

4. Plants of the Gulf Coast, Tamaulipas to Louisiana and Florida, occasionally extending inland on railroad ballast; typically low and spreading, densely covered with soft, gray, felty pubescence, that of the involucres finer and softer than in the species.....2b. *A. skirrhobasis* var. *thalassius.*

3. Involucres (4.5–)5.0–6.3 mm. high; phyllaries in about 3 series; rays broad for their length, 6–8 mm. long, 1.8–2.4 mm. wide; achenes about 1.5 mm. long; pappus typically of 5 or 10 acute, acuminate, or awn-tipped (sometimes also lacerate-ciliate) scales 0.3–1.8 mm. long.....3. *A. Kidderi.*

2. Pappus a ring of very short, equal hairs or ciliae 0.1–2.5 mm. long; corollas only slightly hardened or thickened, at the base or slightly above.....5.

5. Rays 16–42; achenes 1.3–1.5 mm. long; hairs of peduncles rather fine and soft, from slightly swollen bases, sparse to dense, widely spreading to deflexed, 0.3–1.0 mm. long; lower leaves saliently toothed to deeply pinnatifid, passing gradually into the smaller and less divided middle and upper ones, the uppermost 0.5–2.0 cm. long, 0.3–2.0 mm. wide; plants annual or perennial from a taproot.....6.

6. Involucres 3.3–5.0 mm. high; middle phyllaries 0.6–1.1 mm. wide; achenes about 1.35 mm. long, with brown lines or low ridges; pappus about 0.15 mm. long; plants of the Rio Grande Plain of southern Texas, less abundantly on the Edwards Plateau and north to the Panhandle (apparently hybridizes with *A. skirrhobasis*, *A. Kidderi*, and possibly *A. arizonicus*; hybrids with the former may closely resemble the last mentioned species).....5. *A. ramosissimus.*

6. Involucres 4.6–7.0 mm. high; middle phyllaries 1.1–1.8 mm. wide; achenes about 1.5 mm. long, rather prominently ridged or grooved; pappus about 0.25 mm. long; plants of Arizona, New Mexico, and western Texas (possibly hybridizes with *A. skirrhobasis* and *A. ramosissimus;* hybrids between the latter two may key here).....6. *A. arizonicus.*

5. Rays 40–65(–85); achenes 1.5–2.0 mm. long; hairs of peduncles coarse and hispid, from swollen bases, usually rather sparse, widely spreading, 0.2–0.6 mm. long; lower leaves toothed to deeply pinnatifid, passing rather abruptly into the narrowly

oblanceolate or lance-oblong to linear, entire middle and upper, the uppermost 0.5–3.0 cm. long, 0.7–2.8 mm. wide; plants clump-forming perennials from obliquely branched or almost creeping woody bases.....11. *A. Riddellii.*

Section 1. **Pappophanus** (Blake) Shinners, sect. nov.

Aphanostephus subg. *Pappophanus* Blake, Contr. Gray Herb. 53: 24. 1918.

Pappus scaly, uneven, and variously lacerate-ciliate, acutely lobed, or awned, 0.25–1.8 mm. long.

1. APHANOSTEPHUS PILOSUS Buckley, Proc. Acad. Nat. Sci. Phila. 13 (1861): 457. 1862.

A. pulchellus Stevens ex Jeffs & Little, Univ. Okla. Publ., Biol. Surv. 2 (=2): 83. 1930. (Nomen nudum; identity determined from specimens collected by Stevens and distributed under this name.)

Annual from a taproot. Stems 6–33 cm. tall, single, sometimes divided at base, but usually simple for ¼ or ½ their length, divaricately and cymosely branched above, the plant nearly flat-topped, as much as 40 cm. broad; peduncles very short, naked for 3–12 mm., or as much as 25 mm. in age. Whole plant conspicuously hispid-pilose with coarse, jointed, translucent hairs, those of the stem, branches, and peduncles 0.7–2.2 mm. long, spreading at right angles. Stem leaves broadly oblanceolate to linear-lanceolate in outline, the lower (soon withering and falling) deeply parted into 3 or 5 narrowly lanceolate, forward-pointing segments, less often merely with a few salient teeth, or entire; the blades 1.5–3.5 cm. long, 0.8–2.0 cm. wide, the petiolar base 1.0–2.5 cm. long. Middle and upper leaves smaller, less divided or mostly entire, narrowly oblanceolate to linear-lanceolate, the reduced ones below the heads 0.2–1.0 cm. long, 0.3–1.5 mm. wide. Involucres depressed-hemispheric, solitary and terminal on the branchlets, but somewhat crowded, 4.5 5.8 mm. tall in flower, disks 4.0–6.5 mm. across (as pressed). Phyllaries lanceolate,with long, stiff, acuminate tips, coarsely hispid on the back, with very narrow, subscarious, serrulate-ciliate margins; imbricated in about 3–4 series, the outermost about half as long as the innermost; middle and inner phyllaries 0.7–1.0 mm. wide. Rays 12–18, white, sometimes rosy or rosy violet in withering, rarely rose-tinged on the back while in flower, lance-elliptic, 5–7 mm. long, about 1.75 mm. wide. Disk florets (one count) 95, corollas yellow, about 2 mm. long, whitish and more or less hardened in age from about the middle to just above the base, but not inflated. Achenes about 1.5 mm. long, sparsely appressed-pubescent, more or less quadrate, shallowly grooved or ridged. Pappus a distinct, cup-like, shallowly lobed, lacerate-ciliate, scaly crown about 0.3–0.4 mm. long.

Sandy or silty, somewhat damp soil in draws, low prairies, ditches, and similar habitats; southwestern Oklahoma and adjacent Texas. The type was collected by S. B. Buckley on "prairies north of Fort Belknap," which

was about 10 miles west of Graham in Young County, Texas (type in herb. Academy of Natural Sciences, Philadelphia; photo in herb. Southern Methodist University; isotype in Gray Herb.). Flowers from mid May to early July; apparently shows little inclination to flower again in summer or fall, like the other species.

This was relegated to synonymy under *A. ramosissimus* by Asa Gray; but its branching, hispid pubescence, and stiffly acuminate phyllaries are so strikingly characteristic that it is perhaps the one species of the genus which need never be mistaken for any other. The wretched, withered scraps which make up the type and isotype, and the fact that the plant was known from no other material for many years, make Gray's action more understandable than it appears at first.

Additional specimens examined: OKLAHOMA: Comanche Co., near Cache, *G. W. Stevens 13070½* (G); vicinity of Ft. Sill, *Mrs. Joseph Clemens 11813* (G, Mo). Cotton Co., "sedge flat, area 2B," no further information, *Charles Smith 2055* (C-Cl). Kiowa Co.?, Sulphur Flats, Wichita National Forest, *Frank H. Rose 89a* (G). Swanson Co., near Snyder, *Stevens 1210* (G), *1251* (G, Mo). Tillman Co., Frederick, *Mrs. J. F. Duncan 61* (Mo). TEXAS: Archer Co., 3½ miles n. of Windthorst, *Lloyd H. Shinners 7959* (SMU). Childress Co., Childress, *Biology Class*, June 5, 1931 (T). Clay Co., without locality, *B. C. Tharp*, June 13, 1924 (T). Jack Co., 9 miles n.w. of Jacksboro, *Shinners 7947* (SMU). Wichita Co., 1.2 miles s. of Electra, *Eula Whitehouse 9896* (SMU); Wichita Falls, *B. B. Harris 12* (G); 7 miles n. of Wichita Falls, *Shinners 7966* (SMU). Wilbarger Co., Oklaunion, *Julien Reverchon 3311* (Mo).

2a. APHANOSTEPHUS SKIRRHOBASIS (DC.) Trel., Rep. Ark. Geol. Surv. 4: 191. 1891.

Keerlia skirrhobasis DC., Prodr. 5: 310. 1836.
Leucopsidium arkansanum DC., Prodr. 6: 43. 1837.
Egletes arkansana (DC.) Nutt., Trans. Amer. Philos. Soc. n.s. 7: 394. 1840 (dated 1841).
Aphanostephus arkansanus (DC.) A. Gray, Pl. Wright. (Smithson. Contr. vol. 3, art. 5): 93. 1852.
Aphanostephus arkansanus var. *Hallii* A. Gray, Proc. Amer. Acad. 16: 81. 1880.
Aphanostephus skirrhobasis var. *Hallii* (A. Gray) Blake, Contr. Gray Herb. 53: 24. 1918.

An extremely variable and abundant species; for minimum measurements, see remarks on f. *quasigigantiusculus* below.

Annual from a taproot. Stems up to 50 cm. tall, simple or variously branched: simple below, with ascending branches above; or with spreading-ascending to partly decumbent branches from the base, whole plant as much as 50 cm. across. Ultimate branchlets or peduncles naked for 0.5–7.0 cm. Whole plant moderately to very densely gray-pubescent with rather fine and soft hairs, those of the stem and branches irregularly spreading to deflexed or downwardly sub-appressed, 0.2–0.9 mm. long. Blades of lower stem leaves bluntly oblanceolate to oblong-oval, up to 6 cm. long

and 2 cm. wide, on petioles up to 6 cm. long. Middle and upper leaves gradually smaller, shorter-petioled or sessile; uppermost leaves rather abruptly smaller, the first ones below the heads up to 2 cm. long, 3.5 mm. wide. Leaf blades all toothed or pinnatifid, or the lower divided and the upper entire, or all entire. Involucres about 6.0–8.2 mm. high; disk about 7–13 mm. across. Phyllaries lanceolate or the outer narrowly lance-oblong, hispid-pubescent on the back, densely ciliate, imbricated in about 4–5 series, the outermost ⅓–⅔ as long as the innermost; middle phyllaries 1.2–1.8 mm. wide. Rays 20–44; ligules about 8–15 mm. long, 1.5–2.3 mm. wide, white, usually cherry-red to rose-purple on the back, at least in streaks; tube 1–2 mm. long, hardened and swollen at base as in the disk florets. Disk florets (single count) over 280 (medium sized head of normal spring plant); corollas about 2.0–2.5 mm. long, the base becoming whitened, hardened, and bulbous-enlarged in age, up to 1 mm. in diameter, about 2.0–2.5 times its original diameter. Achenes rather prominently grooved, 1.5–2.2 mm. long. Pappus an irregular, lacerate-ciliate scaly crown, or of distinct acute scales of unequal length, 0.25–0.9 mm. long.

Late season form: most of the leaves wanting, plant much branched, the short secondary branches terminating in smaller heads. In mild winters in the southern part of its range, these may survive and begin another period of flowering early the next spring.

Dwarf, early spring form: plants very small (about 3–8 cm. tall), simple, with a single head; leaves about 3–12 mm. long (including petioles, if present), 0.5–3.0 mm. wide, entire or the larger sparingly toothed; involucres 2.6–5.2 mm. high, the phyllaries imbricated in about 2–4 series, softly pubescent and ciliate; rays about 10–18, ligules 4–9 mm. long. Sometimes found with larger, more typical plants, but occasionally all the plants of a locality may belong to this form. Since they are a puzzle in the herbarium, they may be formally designated as *Aphanostephus skirrhobasis* f. **quasigigantiusculus** Shinners, f. nov., plantae minimae simplices monocephalae capitulis parvis. Type from 12 miles south of Fairfield, Freestone Co., Texas, *Shinners 7104* April 9, 1945 (in herb. Southern Methodist University). All the plants seen at the type locality—many thousands of them—were of the small, simple form. It was not until a second collection was made near the same spot, and several had been made elsewhere showing intermediates, that their identity was learned.

Variations in leaf form are quite erratic. It is sometimes possible to find plants with nearly entire leaves and those with pinnatifid or deeply toothed leaves growing together, with few or no intermediates. The difference is quite striking, and plants with deeply cut leaves may receive formal recognition as *Aphanostephus skirrhobasis* f. **incisifolius** Shinners, f. nov., foliis pinnatifidis vel profunde dentatis. Type from 3 miles northwest of Hedley, Donley Co., Texas, *Shinners 8010*, June 21, 1945 (in herb. Southern Methodist University); growing with plants having entire or nearly entire leaves, without intergrades.

Certain puzzling variations of this and other species can perhaps be

explained as due to crossing, with diagnostic characters inherited as independent units. Plants may be intermediate in such features as size of parts and thickening of corollas, but the pappus may seem perfectly characteristic of one or another supposed parent. This is expecially troublesome in the case of intermediates between *A. skirrhobasis* and *A. ramosissimus*, which may combine ciliate pappus with strongly grooved achenes, broad phyllaries, and relatively large heads, precisely the combination of characters which must be relied upon to distinguish *A. ramosissimus* and *A. arizonicus*. From herbarium specimens, one gets the impression that *A. arizonicus* is the common and nearly exclusive species of Trans-Pecos Texas, but that it is found rarely at widely scattered points much farther north and east, giving it a peculiar and illogical pattern of distribution. It seems more reasonable to ignore isolated collections from north and east of the Trans-Pecos in determining the range of *A. arizonicus*. They are listed separately after the citation of other collections of that species. It should be remembered, of course, that the key differences between these species are not the only ones which exist. Intangible characters of habit and behavior, and more-or-less differences in pubescence or foliage also enter into the diagnosis of a species; though they cannot by themselves outline a clear picture, they fill in a characteristic background.

The type of *Keerlia skirrhobasis* was collected by Berlandier in June, 1828, "inter Bejar et flum. Trinitatis," or somewhere between San Antonio and the Trinity, nearly 250 miles to the northeast. It is presumably in the De Candolle herbarium at Geneva, and has not been seen, but the description and locality leave no doubt as to its identity.

Aphanostephus skirrhobasis is one of the most widespread and abundant members of the genus. It is found in sandy or silty open ground, or open oak woods, from south-central Texas to eastern New Mexico, southern Kansas, and perhaps western Arkansas. Its main flowering period is from mid April to June, but it may persist and flower later in the season, or even survive in mild winters into a second year.

Some specimens examined: ARKANSAS: Washington Co., without locality, *Eunice Brackett*, April 21, year not given (T; some sheets from this collector, of other species, are labeled as from Washington Co., Texas, some merely from Washington Co., without state). KANSAS: Harper Co., 2 miles w. of Anthony, *P. A. Rydberg & Ralph Imler 609* (Mo). NEW MEXICO: Chaves Co., Arroyo Ranch, near Roswell, *David Griffiths 5736* (Mo); 15 and ⅔ miles w. of Caprock (in Lea Co.), *V. L. Cory 37654* (G). OKLAHOMA: Caddo Co., 5 miles w. of Bridgeport, *Leslie Hubricht, Cora Shoop & Dorothy B. Heinze B1378* (Mo); Cement, *Demaree 12561* (Mo); Lake Thomas near Ft. Cobb, Wichita National Forest, *C. I. Eskew 1161* (Mo); 3 miles e. of Hydro, *Hubricht, Shoop & Heinze B1384* (Mo). Canadian Co., Canadian River near Ft. Reno, *Laura A. Blankinship*, July 19, 1896 (G, Mo). Cleveland Co., Norman, *W. H. Emig 447* (Mo). Custer Co., Clinton, *E. J. Palmer 12562* (G, Mo). Ellis Co., near Shattuck, *R. L. Clifton*, June 6, 1914 (G). Grady Co., 13 miles s. of Chickasha, *Robert Stratton 279* (Mo). Grant Co., Salt Fork, *Mark White 199* (Mo). Harmon Co., near Hollis, *Stevens 1122* (G). Kiowa Co., 4 miles e. of Hedrick,

R. R. Innes & Brunelle Moon 993 (G). Logan Co., near Guthrie, *Stevens 3256* (G); n. of Guthrie, *George J. Goodman 2123* (Mo). McClain Co., Johnson's pasture, *Fred A. Barkley 1511* (C-Cl, Mo). Oklahoma Co., Oklahoma City, *B. Shimek*, July, 1892 (Mo). Payne Co., 2 miles s. of Perkins, *Joe Ross*, June 16, 1936 (T). Pottawatamie Co., Asher, *Elizabeth Ducker Barkley & Fred A. Barkley 1357* (Mo). Swanson Co., near Mountain Park, *Stevens 1263* (G). Woods Co., near Fairvalley, *Stevens 732* (G, Mo); near Saratoga, *Stevens 538* (G, Mo).. Woodward Co., Woodward, *H. E. Runyon 1104* (C-Cl), *1090* (USNA); n. of Woodward, *Earl Bondy*, May 6, 1937 (Mo). TEXAS: Andrews Co., 8 and $\frac{2}{3}$ miles w. of Andrews, *Cory 37654* (G). Bailey Co., near Coyote Lake, *Roxana S. Ferris & Carl D. Duncan 3443* (Mo); $1\frac{1}{2}$ miles s. of Muleshoe, *Cory 37513* (G); 2 miles s. of Muleshoe, *Shinners 8349* (SMU). Bastrop Co., 5 miles w. of Bastrop, *Shinners 7273* (SMU). Bell Co., railway yards near Heidenheimer, *Simon E. Wolff 2168* (TAM). Bexar Co., San Antonio, *E. H. Wilkinson*, in 1900 (Mo); 17 miles s. of San Antonio, *Sister Mary Clare 27* (C). Brazos Co., w. of Wellborn, *H. Ness*, May 4, 1927 (TAM). Burnet Co., along Colorado River, *Wolff 3226* (TAM); Inks Lake State Park, on the Colorado River w. of Burnet, *Shinners 7220* (SMU). Callahan Co., Brazos, *Reverchon 63* (Mo). Childress Co., without locality, *Biology Class*, Aug., 1929 (T; date questionable, specimen is of the spring form). Comal Co., New Braunfels, *F. Lindheimer field no. 549* (G). Comanche Co., Comanche, *H. Eggert*, May 10, 1900 (Mo). Cottle Co., 19.4 miles e. of Matador, *Whitehouse 9903* (SMU). Crosby Co., 4 miles e. of Crosbyton, *Shinners 8372* (SMU). Dallas Co., Dallas, *Herb. E. Dapprich*, without date (SMU), *B. F. Bush 682* (G, Mo), *Mary Hynes*, June 2, 1926 (T), *Reverchon 441* (C); n. of Eagle Ford, *Eggert*, June 26, 1899 (Mo). Dickens Co., 3 miles n. of Spur, *H. B. Parks & V. L. Cory 13634–35* (TAM). Donley Co., 3 miles n.w. of Hedley, *Shinners 8009* (SMU; growing with *8010*, f. *incisifolius*); 10 miles s. of Clarendon, *F. A. McArty*, May 15, 1944 (T). Duval Co., San Diego, *Tharp*, April 19, 1931 (T). Eastland Co., Ranger, *Hodge Oak Park School*, April, 1935 (T). Erath Co., $7\frac{1}{2}$ miles s.w. of Stephenville, *Cory 39248* (G). Fisher Co., 4 miles s.e. of Rotan, *Shinners 8349* (SMU). Freestone Co., 14 miles s. of Fairfield, *Shinners 7114* (SMU; f. *quasigigantiusculus*, April 9, 1945), *7764* (SMU; typical, May 17, 1945). Gillespie Co., 21 miles n. of Fredericksburg, *Aven Nelson & Ruth A. Nelson 5207* (G); Iron Creek, *G. Jermy, 649* (Mo). Gonzales Co., $10\frac{1}{4}$ miles w. of Monthalia, *Parks & Cory 5964* (TAM); Ottine, *Cory 5815* (TAM), *5816* (G). Grayson Co., $4\frac{1}{2}$ miles n. of Denison, *Shinners 7809* (SMU). Hamilton Co., Hamilton, *Tharp*, June 12, 1941 (G). Hood Co., Granbury, *E. R. Bogusch*, May, 1930 (C-Cl); n. of Granbury, *Eggert*, May 5, 1900 (Mo). Howard Co., n. of Big Spring, *Eggert*, June 11, 1900 (Mo). Jack Co., 9 miles n.w. of Jacksboro, *Shinners 7946* (SMU). Johnson Co., 2 miles n.e. of Cleburne, *Whitehouse 10395* (SMU). Kendall Co., "Fredericksburg" (error for south of Fredericksburg? the town is in Gillespie Co.), *Elizabeth Ammerman 51* (Mo). Kerr Co., without locality, "*W. & N.*," June 6, 1929 (T). Lee Co., 13 miles n. of McDade, *Innes 886* (G). Leon Co., Keechi, *E. J. Palmer 13409* (Mo). Liberty Co., Liberty, *Charles Wright*, no date (G). Llano Co., Enchanted Rock, *Parks & Cory 12973* (TAM); Colorado River 1 mile s. of bridge e. of Llano, *Shinners 7190* (SMU; including f. *quasigigantiusculus*, intermediates, and large plants). Lubbock Co., Lubbock, *Wolff 1997* (TAM). McLennan Co., Waco, *L. Pace 94, 571* (Mo). Medina Co., 2 miles s.w. of Devine, *Shinners 7435* (SMU). Milam Co., between Milano and Gause, *Wolff 3956* (TAM); 12 miles n.e. of

Rockdale, *Innes & Moon 932* (G). Mitchell Co., n.w. ¼ sec. 28 T&PRR block 26, *Richard W. Pohl 4919* (SMU). Montague Co., 8 miles e. of Ringgold, *Whitehouse 10049* (SMU). Nolan Co., Sweetwater, *E. J. Palmer 13754* (Mo). Palo Pinto Co., Brazos, "*Flower Contest,*" May, 1932 (T). Parker Co., Weatherford, *S. M. Tracy 7898* (G, Mo, T, TAM). Runnels Co., 3 miles s.w. of Ballinger, *Cory 39280* (G). Scurry Co., 1 and ⅔ miles s. of Dunn, *Cory 49325* (SMU). Somervell Co., Glen Rose, *Ottys Sanders 199* (SMU). Tarrant Co., Ft. Worth, *N. M. Glatfelter*, June 18, 1898 (Mo); Lake Worth, *A. Ruth 741*, June 10, 1929 (SMU). Taylor Co., n. of Abilene, *Eggert*, June 7, 1900 (Mo); 1 mile n. of Abilene, *W. L. Tolstead 7489* (C-Cl); Buffalo Gap Hills, *Cory 8773* (G); Sayles, *Parks & Cory 8771* (TAM). Terry Co., Wellman, *Tharp*, July 10, 1941 (Mo, SMU, T). Travis Co., Austin, *Elihu Hall 304* (G; type of *A. arkansanus* var. *Hallii*), *Tharp*, May 3, 1936 (G, T); Austin, just above dam, *Tharp*, June 25, 1930 (C, T). Victoria Co., n. of Victoria, *Eggert*, April 11, 1900 (Mo). Waller Co., Hempstead, *Hall 303* (G, Mo). Wichita Co., 10.3 miles n. of Electra, *Whitehouse 10484* (SMU); 10 miles n. of Wichita Falls, *Shinners 7973* (SMU). Wilson Co., without locality, *Dr. E. Palmer 502*, in 1879–1880 (G). Wise Co., 3 miles w. of Decatur, *Shinners 7925* (SMU). Young Co., 3 miles s. of Olney, *Parks & Cory 13175* (TAM).

2b. APHANOSTEPHUS SKIRRHOBASIS var. **thalassius** Shinners, var. nov.

Littoralis, plerumque humilis patulaque, omino densissime pubescens, involucri pilis tenuioribus.

Plants usually low and spreading; leaves most commonly entire, but sometimes toothed or even pinnatifid, appearing somewhat thicker than in the species; whole plant covered with dense, soft, almost felty, gray pubescence; pubescence of the phyllaries rather finer and longer than in the species.

Restricted to sandy beaches and dunes along or near the Gulf Coast, northern Tamaulipas, Texas, Louisiana, and upper Florida; extending inland in dune areas of the lower Rio Grande plain, or on railroad ballast elsewhere. Because of its southern and maritime distribution, it is more apt to survive over winter than is the species proper, and may form irregular, loose, half-buried, nearly leafless mats in drifting sand. The type was collected on the sea shore south of High Island, Galveston Co. (a short distance west of the Chambers and Jefferson Co. lines), Texas, by Lloyd H. Shinners, no. 7718, May 15, 1945 (in herb. Southern Methodist University). The type sheet contains a large over-wintered plant with leafless main stem and branches, leafy and flowering secondary shoots, and undeveloped rosettes of new plants of the current year. Stated to be "abundant in drifting sand on sea shore; rays white, rose violet on back."

The species proper includes so many variations that occasional plants are hard to separate from the coastal form, but the latter shows such uniformity and is so characteristic in appearance that it deserves nomenclatorial recognition.

Some additional specimens examined: TAMAULIPAS: Washington Beach, *R. Runyon 442* (C, US). FLORIDA: Escambia Co., Pensacola, railroad, *A. H. Curtiss, 2nd Distrib. Pl. S. U. S. no. 5916* (C, G, Mo); low grounds, Pensacola,

Curtiss, N. Amer. Pl. no. 1355 (Mo; with "no. 3118" added in ink, without explanation). LOUISIANA: Cameron Parish, Cameron, *Tracy 8549* (G, Mo, TAM); Holly Beach, *D. S Correll & H. B. Correll 9612* (G, Mo); Leesburg, *A. B. Langlois*, Nov. 18, 1891 (C). TEXAS: Aransas Co., s. shore of Burgentine Lake, Aransas Refuge, *Cory*, April 9, 1945 (SMU); ½ mile s. of Spanish Village, Aransas Refuge, *P. B. Uzzell 65* (USNA). Calhoun Co., Farewell Island, *Tharp*, May 22, 1930 (T); Port O'Connor, collector not named, May 19, 1930 (T). Cameron Co., Boca Chica, *K. M. Wiegand & M. C. Wiegand 2330* (G). Chambers Co., 3 miles e. of High Island *Cory 20219* (USNA). Duval Co., ranch of George Frank, *Parks & Cory 14773* (TAM). Galveston Co., Galveston, *Nelson & Nelson 67* (C, G, Mo), *Reverchon 3308* (G, Mo), *Shinners 7738* (SMU); Denver Beach, Galveston, *George L. Fisher*, Sept. 8, 1912 (C-Cl, Mo); Galveston Island, *Lindheimer*, Nov., 1842 (G, Mo), *Tracy 7361* (G, Mo, T); near Galveston, *George W. Letterman*, Aug., 1880 (Mo). Harris Co., Houston, *Fisher 219*, April 11, 1920 (G), *O. Mueller*, July 18, 1929 (C). Jefferson Co., 7 miles s.w. of Beaumont, railroad, *Shinners 7694* (SMU). Kleberg Co., Padre Island, *Cory 49137* (SMU). Nueces Co., Corpus Christi, *Tracy 8935* (G, T). San Patricio Co., Aransas Pass, *C. R. Orcutt 5956* (Mo); near Mathis, *Susan Delano McKelvey 1722* (G).

3. APHANOSTEPHUS KIDDERI Blake, Contr. Gray Herb. 53: 23–24. 1918.

Annual from a taproot, rarely persisting over mild winters into a second year. Stems 7–35 cm. tall, usually much branched nearly from the base, the lower branches widely spreading or almost decumbent, the upper spreading-ascending, the plant as much as 45 cm. across; peduncles naked for 0.5–6.0 cm. below the heads. Whole plant sparsely to moderately densely pubescent with soft, lax hairs, those of the stem and branches widely spreading to slightly deflexed, 0.2–0.9 mm. long. Lower stem leaves (very quickly withering) oblanceolate in outline, entire or toothed to deeply pinnatifid (the most extreme forms possibly due to hybridization with *A. ramosissimus*), the blades 0.7–5.0 cm. long, 0.3–1.8 cm. wide, the petiolar base 0.5–3.0 cm. long. Upper leaves smaller and usually less divided, oblong-spatulate to narrowly oblong, with relatively broad and often slightly clasping bases; uppermost bract-like ones 0.5–2.0 cm. long, 0.2–2.5 mm. wide. Involucres saucer-shaped to broadly urn-shaped, 5.0-6.5 mm. high (rarely as little as 4.5 mm. in dwarf plants), the disk 6–10 mm. broad. Phyllaries oblong-lanceolate, the outer acute, the inner acuminate, with prominent yellow-brown midrib and broad dark-green center, passing through a light yellowish-green zone to the narrowly scarious, serrulate-ciliate margin, often rosy toward the tip, hispid pubescent on the back, imbricated in about 3 series, the outermost about half as long as the innermost; middle phyllaries 0.8–1.2 mm. wide. Ray florets 22–32 (rarely as few as 12 in dwarf plants), ligules white to light rosy violet within, light to dark rosy violet on the back, broadly lanceolate to elliptic and obtuse, 6–8 mm. long, 1.8–2.4 mm. wide, the short tube thickened and enlarged at base as in the disk corollas. Disk florets (one count) over 270, the corollas yellow, about 2 mm. long, in age with whitish, hardened, bulbous-enlarged base twice or more the original diameter of the tube, about 0.7–1.0 mm.

thick. Achenes rather prominently ribbed or grooved, nearly or quite glabrous, about 1.5 mm. long. Pappus a scaly crown, most typically of 5 or 10 acute, acuminate, or awn-tipped, often lacerate-fimbriate scales 0.3–1.8 mm. long, conspicuous pointed tips sometimes developed only above the angles of the achene.

Sandy open ground in the Rio Grande Plain area of southern Texas, very often growing with *A. ramosissimus*, with which it apparently hybridizes. Its main flowering period is from late March to early June, but it may continue as late as August. The type was collected at an unknown locality between San Antonio and Laredo, probably in Frio County, by Nathaniel T. Kidder, probably on March 26, 1885 (in Gray Herb.).

Some additional specimens examined: TEXAS: Brooks Co., Encino, *M. E. Jones 29419* (C). Dimmit Co., 7 miles n.e. of Bigwells, *Shinners 7402* (SMU); 8 miles w. of Carrizo Springs, *W. L. Bray?*, without date (T). Frio Co., 1 mile n. of Dilley, *Shinners 7415* (SMU); Pearsall-Dilley, *P. Hoglund*, April 15, 1930 (T). Hidalgo Co., McAllen, *E. R. Cameron*, Aug. 10, 1937 (T). Kenedy Co., Yturria Ranch, *C. L. Lundell & Amelia A. Lundell 8737* (SMU). La Salle Co., *Fisher 3232*, April 21, 1932 (C; mixed with *A. ramosissimus*). Maverick Co., Eagle Pass, *Bray*, May 25, 1898 (T); without locality, *Tharp*, July 2, 1931 (T). Nueces Co., without locality, *E. P. Stiles*, March 1–10, 1923 (T). Webb Co., Laredo, *E. J. Palmer 11262* (G, Mo); 6 miles s.e. of Laredo, *F. A. Warren 1159* (G). In addition to the preceding may be mentioned a specimen from Beaumont, Jefferson Co., attributed to Reverchon, without further data (Mo); this is surely an error in labeling, for Beaumont is far out of the known or expectable range of the species.

Section 2. **Pappopecus** Shinners, sect. nov.

Pappus minutus ciliatus aequalis 0.1–0.25 mm. longus.

Pappus a very small crown of equal hairs or ciliae 0.1–0.25 mm. long.

This is essentially the same as subgenus *Euaphanostephus* Blake, but since it might some time be found desirable to maintain subgenera, it seems better not to transfer that name. All the known species of *Aphanostephus* seem too closely allied to warrant a division into subgenera.

4. **Aphanostephus potosinus** Shinners, sp. nov.

Annua vel perennis? caulibus erectis vel adscendentibus 15–40 cm. altis parce vel dense pubescentibus pilis patentibus vel deflexis 0.1–0.6 mm. longis. Folia integra vel subpinnatifida, inferiora alato-petiolata, superiora basi amplectentia, suprema angustata 0.5–1.0 cm. longa, usque ad 1.7 mm. lata. Involucra 4.5–7.0 mm. alta, phyllariis lanceolatis angustis (0.7–1.0 mm. latis) 4-5-seriatis parte centrali semper angusta. Flores radii 30–40, ligulis 6–7 mm. longis; fl. disci corollis ca. 2.3 mm. longis. Achaenia 1.1 mm. longa sulcata. Pappus perminutus 0.1 mm. longus. *A. ramosissimo* sat affinis, sed robustior; San Luis Potosi solum incolit.

Annual or perennial from a taproot. Stems erect or ascending, usually several, forking from the middle or below, the branches ascending; 15–40 cm. tall, sparsely to rather densely pubescent with spreading to deflexed

hairs 0.1–0.6 mm. long; peduncles naked for 1.5–6.5 cm. Lower stem leaves (seen in only one specimen in reasonably good condition) with sinuate-toothed blades up to 3.5 cm. long, 1.3 cm. wide, and winged petioles up to 3 cm. long. Middle stem leaves narrowly oblanceolate, entire to subpinnatifid, the base slightly enlarged and somewhat clasping; upper leaves gradually smaller, with broader and more clasping bases, lance-oblong to linear-acuminate, the uppermost 0.5–1.0 cm. long, up to 1.7 mm. wide. Involucres saucer-shaped, 4.5–7.0 mm. high; disks 7–9 mm. broad. Phyllaries imbricated in about 4–5 series, the outermost about half or two thirds as long as the innermost, lanceolate to linear-lanceolate, the dark central portion in all uniformly narrow; middle phyllaries 0.7–1.0 mm. wide. Ray florets 30–40; ligules 6–7 mm. long, color unknown, but apparently white, sometimes tinged with rose on the back. Disk florets (one count) 345, the corollas about 2.3 mm. long. Achenes about 1.1 mm. long, nearly glabrous, rather strongly grooved. Pappus a minute ciliate fringe about 0.1 mm. long.

The type was collected at Guascama, Minas de San Rafael, San Luis Potosi, by C. A. Purpus, no. 5122, June, 1911 (in herb. University of California; isotypes in Gray Herb., herb. Missouri Botanical Garden, and U. S. National Herb.). The narrow phyllaries with uniformly narrow dark centers, giving the involucre the appearance of having been ornamented with vertical lines in heavy pencil, are the most distinctive characteristic of the species. The heads appear rather small for the size of the plant, in spite of their very numerous florets and relatively large involucres. From the collection dates of the few available specimens, it flowers in June, July, August, and November, in various forms; the one good collection showing what corresponds to a spring form, and including the root, is not dated beyond the year. The narrow phyllaries suggest *A. ramosissimus*, but the involucres are larger, the rays and disk florets more numerous, the upper leaves decidedly clasping, and the whole plant stouter and coarser in appearance; and it is known only from San Luis Potosi, south of the range of *A. ramosissimus*.

Some additional specimens examined: SAN LUIS POTOSI: Cardenas, *Fisher 37151*, Aug. 21, 1937 (G). "Plains of Los Charcos" (Charcas), *C. G. Pringle 4024*, July 2, 1891 (US). Rio Verde, *C. R. Orcutt 5433*, Nov. 17, 1910 (Mo). "Chiefly in the region of San Luis Potosi, 22° N. Lat., altitude 6,000–8,000 feet," *C. C. Parry & Ed. Palmer 378* in 1878 (G, US).

5. APHANOSTEPHUS RAMOSISSIMUS DC., Prodromus 5: 310. 1836.

Egletes ramosissima (DC.) A. Gray, Pl. Fendl. (Mem. Amer. Acad. n.s. 4): 71. 1849.

Annual from a taproot. Stems 5–45 cm. tall, usually numerous in well developed plants, with ascending branches, terminating in peduncles naked for 2–8 cm. below the heads. Whole plant sparsely to rather densely pubescent with soft, lax hairs, those of the stem and branches widely spreading or slightly deflexed, 0.3–0.8 mm. long. Lower stem leaves (soon

withering) sometimes numerous and crowded into a rosette-like basal cluster, but usually fewer and not crowded except while the plant is very young, their blades saliently toothed to deeply pinnatifid (rarely entire, on very dwarf plants), sometimes again toothed on the obtuse segments, 0.6–6.0 cm. long, 0.2–2.0 cm. wide, the petiolar bases 0.3–3.5 cm. long, sometimes winged and as much as 2.5 mm. wide. Upper stem leaves slightly smaller, usually less divided; uppermost considerably smaller, entire or nearly so, slightly or not at all clasping, 0.6–2.0 cm. long, 0.3–2.0 mm. wide. Involucres saucer-shaped to broadly campanulate or urn-shaped (in fruit), 3.3 5.0 mm. high in flower, the disk 5–9 mm. broad. Phyllaries broadly to narrowly lanceolate, acute or acuminate, with rather narrow green or brown centers passing through yellowish green or whitish to the narrow scarious serrulate-ciliate margins, hispid pubescent on the back, imbricated in about 3 series, the outermost about ⅔–¾ as long as the innermost; middle phyllaries 0.7–1.1 mm. wide. Rays 16–32 (rarely as few as 12, on dwarf plants), white, often rose or purple on the back, 5.5–7.5 mm. long (as little as 4 mm. in dwarf plants). Disk florets (one count) over 160, corollas yellow, 1.7–2.1 mm. long, in age hardened and thickened at about 0.5 mm. above the base, but scarcely at all swollen. Achenes about 1.35 mm. long, sparsely pubescent, with brown lines or rather obscure ridges. Pappus a minute ciliate crown up to 0.15 mm. long (before maturity the margins of the cupped summit of the achene may give the appearance of a much longer crown).

Common or abundant in sandy or silty open ground in the Rio Grande Plain region of southern Texas and adjacent Tamaulipas; less abundant in suitable localities on the Edwards Plateau and north to the Panhandle, and similarly extending onto the highlands of Nuevo Leon. Flowering chiefly from March to May, but very often continuing until fall. The type was collected by Berlandier, exsiccatae no. 2061, "around San Antonio ('Bejar') and Laredo," probably in 1828. The wording in the original description suggests that more than one collection was included under no. 2061, and an apparent isotype in the Gray Herbarium bears a field tag with no. 651, while the accompanying exsiccatae label bears both no. 651 and no. 2061. Fortunately the several presumable isotypes bearing these numbers in the Gray Herbarium, and herbarium of the Missouri Botanical Garden are all referable to this species. Most of them represent a rather advanced phase, suggesting that they may have been collected on Berlandier's July trip from San Antonio to Laredo (cf. Geiser, 1937).

As already mentioned under *A. skirrhobasis* and *A. Kidderi*, this species apparently hybridizes with them and possibly with *A. arizonicus*. It is most abundant and appears in most characteristic form in the Rio Grande Plain region of southern Texas. Plants from outside this area, in the United States or Mexico, tend to have a somewhat coarser appearance. In some cases this may be due to crossing with other species, but it may perhaps be regarded as an indication of selection accompanying emigration from an original home in the lowlands.

Some additional specimens examined: NUEVO LEON: Monterey, *Dr. J. Gregg 159* (Mo); Monterey, San Rafael, *Brother G. Arsène 6204* (Mo, US; one sheet is marked "Bro. Abbon #125"). TAMAULIPAS: vicinity of Victoria, *Dr. E. Palmer 558* in 1907 (C, Mo, US). Vicinity of San Jose, cerro Tinaja, Sierra de San Carlos, *H. H. Bartlett 10339* (US). TEXAS: Archer Co., 19.6 miles s. of Electra, *Whitehouse 9722* (SMU). Atascosa Co., Pleasanton, *E. J. Palmer 9743* (Mo). Bexar Co., 3 miles n.w. of San Antonio, *Sister Mary Clare 18* (C; same, without number, TAM, USNA); 10 miles s.w. of San Antonio, *Shinners 7436* (SMU). Callahan Co., Baird, *Letterman*, Aug., 1882 (Mo). Carnes Co., Kenedy, *A. A. Heller 1780* (C, G, Mo). Dimmit Co., s. of Zavala Co. line 5 miles s.e. of Crystal City, *Shinners 7390* (SMU). Edwards Co., 12 miles s.e. of Rocksprings, *Shinners 7345* (SMU); Pasture I, Ranch Experiment Station (s. of Sonora, Sutton Co.), *Cory 4650* (TAM). Frio Co., 6 miles n. of Pearsall, *Shinners 7425* (SMU); 11 miles w. of Dilley, *Shinners 7410* (SMU). Hidalgo Co., La Joya (Sam Fordyce), *Mrs. E. J. Walker 33* (G, T). Howard Co., Big Spring, *Letterman 17* (Mo). Jim Wells Co., Alice, *E. J. Palmer 11252* (G). Kleberg Co., Kingsville, *M. M. High 63* (Mo), *H. C. Benke 5458* (G). Lamb Co., 6 miles s.e. of Littlefield, *Shinners 8357* (SMU). La Salle Co., Cotulla, *Fisher 3232*, April 21, 1932 (C; mixed with *A. Kidderi*); Yeager Pasture, South Texas Syndicate Ranch, near Quintana office, *C. L. Lundell & Amelia A. Lundell 13874* (SMU). Live Oak Co., northern part, Randall Ranch e. of Swinney Switch, *Whitehouse 10329, 10331* (SMU). Maverick Co., Eagle Pass, *M. E. Jones 28017* (Mo). Medina Co., 3 miles w. of Castroville, *Shinners 7288* (SMU); D'Hanis, *Whitehouse*, March 31, 1933 (T), 2 miles w. of D'Hanis, *Shinners 7304* (SMU). Nueces Co., Corpus Christi, *Heller 1404* (G, Mo), *Tracy 8935* (Mo, TAM). Potter Co., Amarillo, *Reverchon 3307* (Mo). Real Co., 1 mile n. of Leakey, *Shinners 7324* (SMU). Starr Co., Rio Grande City, *Tharp*, Feb. 2, 1930 (G). Tarrant Co., vicinity of Ft. Worth, *Whitehouse 10392* (SMU). Taylor Co., Abilene, *Tracy 7866* (Mo); n. of Abilene, *Eggert*, June 4, 1900 (Mo; not typical). Uvalde Co., 6 miles n. of Laguna, *Shinners 7358* (SMU); 8 miles w. of Sabinal, *Shinners 7305* (SMU); Uvalde, *E. J. Palmer 12293* (Mo), w. of Uvalde, *M. E. Jones 28018* (C), 9 miles s.e. of Uvalde, *Cory 15015* (USNA). Webb Co., without locality, *Ecology Class*, Feb. 28, 1930 (G; probably the same, collector not named, Feb. 27, 1930, T). Wilbarger Co., 11.8 miles w. and 0.6 miles s. of Electra, *Whitehouse 9805* (SMU); 10 miles s.e. of Vernon, *Shinners 7978* (SMU). Zavala Co., 15 miles n. of Crystal City, *Shinners 7375* (SMU).

6. APHANOSTEPHUS ARIZONICUS A. Gray, Proc. Amer. Acad. 16: 81. 1880.

This species has generally passed as *A. humilis* (Benth.) A. Gray.

Annual, or sometimes perennial, from a taproot. Stems 5–35 cm. tall, single or few, erect or ascending, larger plants becoming much branched, with ascending or spreading-ascending branches, terminating in peduncles naked for 1.5–8.0 cm. below the heads. Whole plant uniformly and rather densely pubescent with soft gray hairs, those of the stem and branches widely spreading or slightly deflexed, 0.3–1.0 mm. long. Lower stem leaves (soon withering) rather crowded toward the base of the plant, saliently toothed to pinnatifid (rarely entire, on dwarf plants), the blades 0.4–4.0 cm. long, 0.2–2.0 cm. wide, narrowed to a slightly winged petiolar base 0.3–5.0 cm. long, up to 3 mm. wide. Upper leaves smaller and usually less

divided, the uppermost bract-like ones 0.5–1.5 cm. long, 0.5–2.0 mm. wide, sometimes with rather broad and more clasping bases, but usually not clasping. Involucres saucer-shaped to broadly urn-shaped (in fruit), 4.6–7.2 mm. high in flower, the disk 7–11 mm. broad (rarely as little as 6 mm. in dwarf plants). Phyllaries lance-oblong or oblanceolate, acute or the inner acuminate, with prominent rather narrow (but lanceolate rather than linear or narrowly oblong) green or brown centers, bordered by a broad yellowish green or whitish zone, passing into the very narrow, scarious, serrulate-ciliate margin, hispid-pubescent on the back, often rosy or violet tinged at the tip, imbricated in about 3–4 series; middle and inner phyllaries 1.1–1.8 mm. wide. Rays 24–42 (as few as 16 dwarf plants), white, often rosy or violet on the back, ligules 6–9 mm. long, the short tube slightly hardened or thickened near the base. Disk florets (one count) 93, corollas yellow, 1.8–2.5 mm. long, in age hardened and slightly swollen at about 0.5 mm. above the base. Achenes about 1.5 mm. long, distinctly to prominently ridged or grooved, sparsely pubescent. Pappus a rather minute ciliate crown up to 0.25 mm. long.

In sand or silt, especially in dry stream beds or washes, or erosion aprons, southeastern Arizona to western Texas, Coahuila, and Chihuahua; doubtfully as far south as Durango and Zacatecas. From late March or April to June, it flowers in its primary form, with stems nearly or quite erect and little branched, and rather crowded lower leaves all present. By some chance, a large proportion of the Chihuahuan collections represent this phase at its best; some of the plants are quite stout, with rather large heads (the maximum measurements of involucres and rays are from these), and hardly seem to belong to the same species in its later phase, which most of the United States collections represent. From July to September or later, the plants lose most of the main stem leaves, and become much branched, with slightly smaller and considerably more numerous heads than in the spring. If severely trampled or otherwise damaged, they may turn into small, matted tufts with short branches and small, very densely gray-pubescent leaves.

The type was collected at an unspecified locality in the Gila Valley, Arizona, by J. T. Rothrock, no. 336, July, 1874 (in Gray Herb.); it is a fragment representing the summer phase, in rather poor condition.

Some additional specimens examined: CHIHUAHUA: Bachimba, *Gregg 541*, April 29, 1847 (Mo). Near Chihuahua, *Pringle 175* (C, G, US), *956* (Mo); *Harde LeSueur*, July 29, 1936 (Mo); vicinity of Chihuahua, *Dr. E. Palmer 11* in 1908 (Mo, US). Santa Eulalia hills (near Chihuahua), *E. Wilkinson 15* (US). Rio Florido, Ciudad Jimenez, *Stephen S. White 2107* (G). Seven miles n.e. of La Morita, *Ivan M. Johnston 7970* (G). Two miles s. of San Fernando (40 miles n.e. of Camargo), *Johnston 7946* (G). COAHUILA: Buena Vista (battlefield, about 10 miles n.e. of Saltillo), *Gregg 741*, May 22, 1847 (Mo; probably the same, without data, G). Fraile, 59 kilom. s. of Saltillo, lat. 25° long. 101°15′ W., *L. R. Stanford, K. L. Retherford & R. D. Northcraft 243* (Mo). Two miles n.w. of Frontera, *Johnston 7186* (G). Between Hipolito and Sacramento, Municipio de Ramos Arizpe, *F. Lyle Wynd & C. H. Mueller 75* (G, Mo, US). Ten miles s. of Hacienda La Babia, Municipio de Muzquiz, *Wynd &*

Mueller 425 (G, with foreign fragments; Mo, US). Monclova, *Dr. E. Palmer 459* in 1898 (C, G, Mo, US; short peduncles slightly approaching *A. humilis*). Saltillo, *Fr. Adole L. 38* (US). Torreon and vicinity, *Dr. E. Palmer 459* in 1898 (C, G, Mo, US). Cañon del Indio Felipe, ca. lat. 38°33′, in the igneous Sierra Hechiceros close to the Chihuahuan border, *Robert M. Stewart 188* (G). ARIZONA: Greenlee Co., San Francisco Mts. near Clifton, *E. L. Greene Pl. Ariz. 109* (G). Pinal Co., Redrock, *J. W. Toumey Fl. Ariz. 631* (G). Also listed from Benson, Cochise Co., by Blake in Kearney & Peebles, Flowering Plants and Ferns of Arizona (U.S.D.A. Misc. Publ. 423), p. 913, 1942. NEW MEXICO: Bernalillo Co., near Albuquerque, *E. J. Palmer 31184* (G); 2 miles e. of Albuquerque, *Dr. Alfred L. Kammerer 31* (G). Chaves Co., Roswell, *F. S. Earle & Esther S. Earle 344* (G); 4 miles n.e. of Roswell, *Neva Adelaide Palmer 11* (USNA). Dona Ana Co., near Brazilo, *Marion Child*, May-June, 1926 (Mo); Las Cruces, *E. O. Wooton 7* (G); Organ Mt. watershed, Las Cruces, *L. D. Love*, April 7, 1936 (USNA); Mesilla Valley, along railroad near Mesilla Park, *Paul C. Standley 22* (G). Eddy Co., 3 miles n. of Texas state line near U.S. Highway 62, between Delaware Mts. and Rustler Hills, *U. T. Waterfall 5744* (G). Sandoval Co., Bernalillo, *Brother G. Arsène 21836* (C). Sante Fe Co., 10 miles n. of Sante Fe, *A. A. Heller & E. Gertrude Heller 3665* (G). Sierra Co., Casa Grande 2 miles e. of Lava, *S. B. Benson 372* (C). Socorro Co., 1 mile s.e. of San Marcial, *Benson 372* (C). TEXAS: Brewster Co., Alpine, *Barton H. Warnock*, May 15, 1938 (G); Glass Mts., *Warnock 21271* (C-Cl, T); s. of Marathon, *Wolff 4746* (TAM); Dog Gap, Santiago Mts., *Cory 18370* (USNA). Culberson Co., near Daugherty, 30 miles n. of Van Horn, *Waterfall 4103* (G); about 17 miles e. of Salt Flats, *Waterfall 3804* (G, Mo); Sierra Diablos, 23 miles n. of Van Horn, *Waterfall 5173* (G); 7 miles n. of Van Horn, *Waterfall 4650* (G). El Paso Co., El Paso-Newman, *Whitehouse*, Oct. 25, 1931 (T); Hueco Tanks, *Whitehouse*, Nov. 7, 1931 (T). Hudspeth Co., McNary-Ft. Quitman levee road, *Waterfall 4597* (G, Mo). Pecos Co., n. of Pecos, *Nelson & Nelson 4996* (G); without locality, *Tharp 43–880* (SMU, T). Presidio Co., Marfa, *L. C. Hinckley 664* (G, SMU, T); near Porvenir, *Waterfall 4760* (G, Mo, SMU). Val Verde Co., Del Rio, *Cory*, March 18, 1927 (TAM); Devils River, *Orcutt 6209* (Mo); Juno, *Cory 753* (G).

As mentioned under *A. skirrhobasis*, intermediates between that species and *A. ramosissimus* are difficult to distinguish from *A. arizonicus*. Such plants appear to be more common, or to survive better, toward the northern limit of the range of the presumed parents. True *A. arizonicus* may extend as far east as Sutton and Tom Green Counties on the Edwards Plateau of Texas, but probably does not occur farther north. My own collections from the Panhandle in 1945 included only *A. ramosissimus*, *A. skirrhobasis*, and one or two which seemed to be intermediates between these two; there were none of true *A. arizonicus*. I am therefore inclined to believe that the few Panhandle specimens which look like *A. arizonicus* are not really that species at all. As mentioned before, it is necessary to have good material at the right stage to be able to identify it with any confidence. Collections from as far east as Travis County, below the Edwards Escarpment, can be considered intermediates without much hesitation. Most, perhaps all, of the following collections cannot be determined as *A. arizonicus* without misgivings. They are listed together as of questionable identity:

NEW MEXICO: Curry Co., Clovis, *Whitehouse*, Sept. 3, 1929 (T). (Clovis is on the High Plains east of the Pecos Section, i.e., in the same geological area as the Texas Panhandle.) TEXAS: Edwards Co., Texas A. & M. Substation 14 (s. of Sonora, Sutton Co.,) *Cory 5538* (TAM), *Cory 37101* (G); Experiment Station Pasture D, *Cory 3533* (G). (Typical *A. ramosissimus* is known from Edwards Co.; some of these look like immature *A. skirrhobasis*, the rest are probable crosses.) Fisher Co., 4 miles s.e. of Rotan, *Shinners 8394* (SMU), growing with typical *A. skirrhobasis*. Maverick Co., Eagle Pass, *M. E. Jones 78021* (C). Potter Co., Amarillo, *Reverchon 3307* (Mo; some duplicates apparently straight *A. ramosissimus*). Sutton Co., Sonora, *M. E. Jones 25854* (Mo). Taylor Co., Camp Barkeley, *Tolstead 7072* (C-Cl); Abilene, *Tracy 7866* (G; duplicate in Mo is apparently *A. ramosissimus*). Travis Co., Colorado River, Austin, *Tharp*, May 16, 1939 (C-Cl, Mo). Tom Green Co., Christoval, *Parks & Cory 12441–42* (TAM); near Christoval, *Wolff 4206* (TAM); San Angelo, *E. J. Palmer 10318* (Mo). Travis Co., Colorado River at Austin, *Tharp*, May 16, 1939 (C-Cl, Mo).

7. APHANOSTEPHUS HUMILIS (Benth.) A. Gray, Proc. Amer. Acad. 16: 81. 1880. (Published without synonym, with Latin diagnosis, as if entirely new, but from later treatment and synonymy in the Synoptical Flora, clearly intended as a transfer of Bentham's *Leucopsidium humile*.)

Leucopsidium humile Benth., Plantae Hartwegianae p. 18. 1839.
Egletes humilis (Benth.) T. & G., Fl. N. A. 2: 411. 1843.

This name has been used for *A. arizonicus*, and for all the Mexican species except *A. ramosus* (DC.) A. Gray.

Annual or sometimes perennial from a taproot. Stems usually several or numerous, ascending, widely spreading, or decumbent except at the tips, 7–30 cm. (or probably more) long, simple or sparingly forked (or when buried by overwashed or wind-blown soil, putting forth numerous erect laterals; or becoming much branched following injury to the tip); peduncles naked for 0.3–3.5 cm. below the heads. Whole plant densely gray-pubescent, the hairs of the stem spreading to downwardly appressed, 0.2–0.5 mm. long. Basal leaves (soon withering) spatulate to obtusely oblanceolate in outline, the blades shallowly to deeply crenate or pinnatifid, 0.8–2.0 cm. long, 0.5–1.3 cm. wide, the petiolar base 0.6–2.2 cm. long. Lower stem leaves similar but smaller, the upper gradually reduced (but sometimes more deeply divided) and with less narrowed bases, or the uppermost even slightly auriculate and clasping, those just below the heads 2–8 mm. long, up to 1 mm. wide. Leaves, especially the upper, often ruffled or crisped. Involucres saucer-shaped to urn-shaped, (4.1–)5.0–7.0 mm. high; disks 7–12 mm. broad. Phyllaries lanceolate to lance-oblong or oblanceolate-oblong, hispid pubescent on the back, the middle and inner with broad yellowish margins, the outer almost wholly green, imbricated in about 3–5 series, the outermost about half as long as the innermost; middle phyllaries 1.2–1.7 mm. wide. Rays 27–32, ligules 6–10 mm. long, color when fresh not known, but probably white within, rose-violet on the

back. Disk florets (one count) over 340, corollas 2.7–3.0 mm. long, not enlarged, scarcely even hardened at base in age. Achenes sparsely pubescent, rather strongly ridged, 1.3–1.5 mm. long. Pappus a minute ciliate crown about 0.15 mm. long.

Collectors in Mexico, except very recent ones, have been habitually reticent about the plants they collected. Consequently nothing can be said about this species except that it apparently is like those of the United States in preferring sandy or silty ground, and its probable main flowering time is in the spring. The type was collected by Karl Theodor Hartweg, no. 131, in 1837, in fields, Leon, Guanajuato (isotype in Gray Herb.); the collection included a number of plants of the early phase, in good condition, and as in *A. arizonicus*, it requires a good deal of study to connect them with those specimens representing the larger, greener, later phases. Too little material is available to make it possible to say more than that it is probably as highly variable as the United States species; even the few collections cited below show considerable variation.

Some additional specimens examined: DURANGO: city of Durango and vicinity, *Dr. E. Palmer 132* in 1896 (C, G, Mo, US); Durango City, *E. W. Nelson 4590* (G, US; approaching *A. arizonicus*). SAN LUIS POTOSI: "ex convalli San Luis Potosi in arenosis circ. . . . ," *J. G. Schaffner 313*, Aug., 1876 (G), *314* (G) (both probably from near the city of San Luis Potosi); San Luis Potosi (city?), *Prof. G. Barroeta*, without date, (US). Without locality, *Parry & Palmer 373* in 1878 (Mo). STATE NOT DETERMINED: Tuyehuaco, *F. Salazar*, May, 1913 (US). "Mexico," *Orcutt 5132* (Mo).

8. **Aphanostephus jaliscensis** Shinners, sp. nov.

Annua vel perennis, caulibus plerumque pluribus ramosis erectis vel adscendentibus 20–35 cm. altis. Folia inferiora profunde pinnatifida, petiolata, anguste oblongo-lanceolata, superiora gradatim minora plus minusve amplectentia, suprema 0.7–2.0 cm. longa, 1–5 mm. lata; pedunculi 2.0–7.5 cm. longi. Involucra 5.5–7.2 mm. alta phyllariis 3–4-seriatis late subscarioso-albo-marginatis mediocribus 1.2–1.5 mm. latis. Flores radii 26–34, ligulis 7–9 mm. longis; fl. disci 302, corollis ca. 2.9 mm. longis. Achaenia 1.6–2.0 mm. longa, pappus ciliatus ad 0.2 mm. longus.

Annual or perennial from a tough taproot. Stems one or several, branched from near the base, erect or ascending, 20–35 cm. tall; peduncles naked for 2.0 7.5 cm. below the heads. Whole plant rather densely and softly gray-pubescent, the hairs of the stem widely spreading or slightly deflexed, 0.3–0.8 mm. long. Basal leaves not known; apparently quickly withering. Lower stem leaves oblong-lanceolate, the blades pinnatifid, divided nearly to the midrib, 3–5 cm. long, 1 2 cm. wide, the few lobes (2–4 pairs) narrowly oblong-oblanceolate, subacute, more or less directed forward, the basal pair very small, the apical lobe varying from broad and 3-toothed to narrowly oblong-lanceolate, the narrowly winged petiole 1.8–5.0 cm. long, expanded at base and more or less clasping. Upper leaves gradually smaller, with narrower segments or entire, with more broadly

winged petioles or sessile, and with more or less clasping, auricled bases. Uppermost bract-like leaves simple and entire or with a few salient, narrow teeth, often ruffled, linear to lanceolate-acuminate from the broad base, 0.7–2.0 cm.long, 1–5 mm. wide. Involucres broadly campanulate or urn-, shaped, 5.5–7.2 mm. high (as little as 5 mm. on shoots from injured plants); disks 8–12 mm. broad. Phyllaries oblong-lanceolate, pubescent on the back with rather long, whitish hairs, acute to subacuminate, with broad, whitish, subscarious margins nearly $^2/_5$ the total width on either side the dark lanceolate center, rarely slightly purple-tinged at the apex, imbricated in about 3–4 series, the outermost about half or two thirds as long as the innermost. Rays 26–34, ligules 7–9 mm. long, color unknown but apparently white throughout, or occasionally pink or rose on the back when in bud. Disk florets (one count) 302, corollas about 2.9 mm. long, not noticeably hardened or enlarged at base in age. Achenes 1.6–2.0 mm. long, sparsely pubescent, rather strongly grooved or ridged. Pappus a ciliate fringe up to 0.2 mm. long.

Severely injured forms of this plant have short, irregular branches from the bases or decumbent stems of the old plants; these and the small leaves very densely gray-pubescent; peduncles naked for as little as 1 cm., involucres as small as 5 mm. high. The type was collected in fields at Guadalajara, Jalisco, by C. G. Pringle, no. 9440, May 15, 1901 (in Gray Herb.; isotype in U .S. National Herbarium), and represents the primary flowering form. The Safford specimen cited below bears on the label the common name "Margarita del Campo."

Additional specimens examined: JALISCO: Guadalajara, *Wm. E. Safford 1380*, Feb. 23, 1907 (US), *1381*, same date (US). Rio Blanco, *Dr. E. Palmer 64* in 1886, June (G; same, month not indicated, US).

The following two specimens have foliage resembling that of *A. jaliscensis*, and are similar in branching; other features are not decisive with respect to their identity, and they are perhaps merely forms of *A. humilis*, or the Zacatecas specimen even of *A. arizonicus*:

QUERETARO: road to Cadereyta, near San Juan del Rio, *J. N. Rose, Joseph H. Painter & J. S. Rose 9625* (G). ZACATECAS: Ojo Caliente, *Marcus E. Jones 264*, May 9, 1889 (US).

9. APHANOSTEPHUS RAMOSUS (DC.) A. Gray, Proc. Amer. Acad. 16: 81. 1880.

Keerlia ramosa DC., Prodr. 5: 310. 1836.

Perennial from a hardened taproot. Stems 15–25 cm. tall, the younger parts yellowish green, sparsely to moderately densely pubescent with retrorsely appressed to loose and spreading, rather fine, often crisped hairs 0.2–0.5 mm. long; sparingly branched, terminating in peduncles naked for 1.5–5.5 cm. below the heads. Leaves usually green, sparingly to rather densely pubescent, obtusely oblanceolate in outline, entire or toothed (no good basal or lower stem leaves seen). Upper leaves similar but smaller,

narrowly oblong or slightly dumb-bell shaped (broadened at base and toward tip) to deltoid-oblong or lanceolate-oblong, more or less clasping (less clasping and narrower on late shoots or shoots of damaged plants), the uppermost bract-like ones 6–15 mm. long, up to 3 mm. wide. Involucres about 5–7 mm. high, disk 7–10 mm. broad. Phyllaries lanceolate to oblong-lanceolate, sparingly pubescent on the back, imbricated in about 3–4 series, the outermost about a third or two thirds as long as the innermost; the inner acuminate, the others acute to acuminate, the middle ones 1.3–1.6 mm. wide. Rays 20–33, ligules 6–9 mm. long, white within, rose-purple on the back. Disk florets (one count) over 300 (from head on second shoot), corollas about 2.8 mm. long, becoming slightly hardened at the very base, but scarcely enlarged. Achenes about 1.5 mm. long, sparsely pubescent, more or less grooved or ridged. Pappus a ciliate fringe about 0.15 mm. long.

Unfortunately not a single good specimen of this was available; the description is drawn from fragments of out-of-season plants. The type was collected at "Tlapujahua, Oaxaca," according to the label of an apparent isotype in the Gray Herbarium, by F. W. Keerl, for whom the genus *Keerlia* was named. The locality, at which Keerl collected a considerable number of other plants, is doubtless the modern town of Tlapujahua in Michoacan. The isotype in the Gray Herbarium (photos in herb. Missouri Botanical Garden and herb. Southern Methodist University) is part of a branch including a single head (from which most of the florets have fallen) and a single reduced upper leaf. The sparse, downwardly appressed, fine pubescence and slightly clasping upper leaf are quite distinctive, however, and make its identity fairly certain.

Additional specimens examined: MEXICO STATE: Amecameca, 8100 ft., *Fisher*, July 25, 1924 (Mo, US; fragmentary late shoots). MICHOACAN: Lake Chapala, *Mr. & Mrs. J. G. Lemmon 112* (C; state not given; it is assumed to be on the eastern instead of the western end of the lake in Jalisco). Tancitaro municipality, open field 1 mile s. of Tancitaro, 6200 ft., *William C. Leavenworth 384*, July 27, 1940 (Mo).

9. **Aphanostephus pachyrrhizus** Shinners, sp. nov.

Perennis e radice simplice interdum (an frequenter?) crasso, caulibus pluribus vel numerosis decumbentibus, foliis plerumque linearibus integris vel parce laciniato-dentatis lobis angustis. Capitula magna (involucra 5–8 mm. alta, fl. radii 30–40), pedunculos 2–5 cm. longos terminantia. Species austro-Mexicana ut videtur monticola.

Perennial from a taproot which is sometimes slightly swollen toward the summit (missing from too many specimens to tell its prevalence or significance). Stems usually numerous, flexuously divergent and decumbent except near the tip (but late shoots, or those from injured plants, very irregular), simple or with few branches, terminating in peduncles naked for 2–5 cm. below the heads. Type and a few other specimens (very old plants?) showing a distinct, narrow, above-ground crown, the younger

or sterile shoots arising from the higher center. Whole plant rather densely pubescent with whitish hairs, those of the stem 0.2–0.4 mm. long, widely spreading to deflexed, or somewhat matted beneath the heads. Basal leaves (soon withering) oblanceolate to spatulate, sparingly toothed toward the apex, 2–3 cm. long (including 4–6 mm. of petiolar base), 3.5–7.0 mm. wide. Lower stem leaves narrowly oblanceolate to linear, 1.5–2.5 cm. long, 1.5–2.5 mm. wide and entire, or laciniate-toothed or pinnately parted into narrow segments, the whole width as much as 8 mm.; the upper slightly smaller, the first ones below the heads 0.5–1.5 cm. long, about 1.0–1.5 mm. wide, little or not at all clasping (except in one collection from Hidalgo). Involucres saucer-shaped to broadly urn-shaped, 5–8 mm. high, the disk 8–12 mm. broad (heads smaller on late shoots). Phyllaries oblong-lanceolate, acute, hispid-pubescent on the back, the margins minutely erose and ciliolate, imbricated in about 4 series, the outermost about a third to two thirds as long as the innermost, the inner with scarious margins and rose-purple tips, the middle about 1.3–2.0 mm. wide. Rays 30–40, ligules 6–9 mm. long, white within, pink to rose-purple on the back. Disk florets (one count) 318, corollas dark yellow, about 2.5 mm. long, scarcely hardened or thickened at base. Achenes about 1.5 mm. long, nearly glabrous, shallowly sulcate or grooved. Pappus a ciliate crown about 0.2 mm. long.

A low, prostrate, mat-forming plant, growing in sandy open ground, at relatively high elevations (6,500–10,000 ft.), in south-central Mexico. The type was collected at Esperanza, Puebla, by C. A. Purpus, no. 5627, in September, 1911 (in herb. University of California; isotypes in Gray Herb., herb. Missouri Botanical Garden and U. S. National Herbarium); it appears to represent a primary flowering form, though additional material may show that the simple and entire-leaved form, to which the type belongs, is a fall phase, while plants with deeply cut leaves are more characteristic of an early phase.

Additional specimens examined: HIDALGO: near Metepec Station, *Pringle 13023* (G, US; doubtfully this: the upper leaves are more or less clasping). MEXICO STATE: "San Angel, Vallée de Mexico," *Bourgeau 586*, Aug. 10, 1865–66 (sic) (G, US). Pungarabato, distr. Coyuca, *George B. Hinton et al. 6003*, May 5, 1934 (G). PUEBLA: Calchicomula, *J. N. Rose & Robert Hay 5667*, July 24, 1901 (G, US). Esperanza, on dry sandy banks along edges of cultivation, prostrate habit, forming mats to 18″ across, *Edward K. Balls 4496*, May 13, 1938 (US). Vicinity of Puebla, *Brother Nicolas* (*Arsène no. 5277a*), July 20, 1910 (US); vicinity of Puebla, Laguna San Baltasar, *Brother G. Arsène 1114*, May 9, 1907 (Mo, US). TLAXCALA: Mt. Malinche, 8300 ft., sunny sand banks, among thin grass, etc., prostrate mat-forming habit to 12″ across, *Balls 4860*, June 21, 1938 (US). VERA CRUZ: Mt. Orizaba, 10,000 ft., *Rose & Hay 6350*, July 25–26, 1901 (G, US); Mt. Orizaba, 10,000 ft., *Henry E. Seaton 377*, Aug. 5, 1891 (G, US). STATE NOT DETERMINED: Ixtaccihuatl, *Purpus*, Feb., 1903 (C).

11. APHANOSTEPHUS RIDDELLII T. & G., Fl. N. A. 2: 189. 1842.

A. perennis Wooton & Standley, Contr. U. S. Nat. Herb. 16: 189. 1913.

This species has generally not been distinguished from *A. ramosissimus*.

Perennial from a more or less woody, simple and erect, but soon much forked caudex, the divisions oblique, almost creeping; old plants forming dense clumps as much as 35 cm. across. Stems erect or ascending, 10–50 cm. tall, with erect or ascending branches, terminating in conspicuously long peduncles naked for 2–10 cm. below the heads in flower, 3–15 cm. in fruit. Stems, branches, and leaves glabrate to moderately densely pubescent with hispid hairs from swollen bases, widely spreading or slightly curled and appearing very slightly deflexed, 0.2–0.6 mm. long. Lower stem leaves rather crowded toward the base of the plant, oblanceolate, dentate to deeply pinnatifid, the lobes entire or again toothed, acute or obtuse; blades 2.5–7.5 cm. long, 1.0–2.8 cm. wide, narrowed to a petiolar base 2.0–4.5 cm. long. Middle and upper leaves rather abruptly smaller and nearly or quite entire, narrowly oblanceolate or lance-oblong, the uppermost linear, 0.5–3.0 cm. long, 0.8–2.7 mm. wide. Involucres saucer-shaped to broadly urn-shaped, 4.5–6.2 mm. high; disk 9–14 mm. broad. Phyllaries lance-oblong, acute or the inner acuminate, hispid on the back, with prominent narrow green or brown centers bordered by a broad greenish zone, passing into the narrow, scarious, glabrous, and nearly or quite entire margin, imbricated in about 3–4 series, the outermost very narrow ones about a third or half as long as the innermost; middle phyllaries 0.8–1.1 mm. wide. Rays 40–65(–85), ligules white, 7–10 mm. long. Disk florets (one count) over 230, corollas yellow, 2.2–3.2 mm. long, only slightly hardened or thickened at base in age, not swollen. Achenes 1.5–2.0 mm. long, nearly or quite glabrous, rather faintly ridged or grooved. Pappus a rather minute ciliate crown, rarely as much as 0.2 mm. long.

Late season form (or second flowering of browsed or trampled plants): usually lower and bushier than the spring form; lower leaves withered and fallen, those present usually all very narrow and entire or nearly so, often with axillary fascicles of still smaller leaves; naked portion of peduncles rarely as much as 10 cm. long. Heads slightly smaller and fewer-flowered, the involucres 4.0–5.2 mm. high, disk 7–12 mm. broad, rays about 25–40.

This is one of the easiest species to recognize in the field, by reason of its perennial, clump-forming habit, resembling some of the species of *Erigeron*, with which it often grows, and by its long, naked peduncles. It is also often associated with all the United States species except *A. pilosus*, but no intermediates or presumable hybrids have been seen. Fragmentary herbarium specimens can be easily recognized by the remarkably constant, coarse, hispid, and rather sparse hairs of the peduncles, not matched in any other species. Its main flowering period is from late March to early June, but it very commonly flowers again between June and October or even later, in a fashion reminiscent of *Leucelene ericoides*. It is found in

greatest abundance on the limestone of the Edwards Plateau of Texas, less commonly in sand or silt on the Rio Grande Plain, and as far west as southeastern New Mexico; in Coahuila and Nuevo Leon it occurs on the highlands corresponding to the Edwards Plateau, and on the Rio Grande Plain. The type was collected in Texas by Dr. J. Riddell, date and locality not given, but Dr. Geiser informs me that it probably was collected in late spring, 1839, between Austin and Kerrville, an area in which it is very common (type or isotype in Gray Herb., poor fragments of summer form, without root, which in the original description is said to be hard and woody).

Some additional specimens examined: COAHUILA: near Diaz, *Pringle 9024* (G, Mo). Hacienda La Rosita, Municipio de Muzquiz, *Wynd & Mueller 288* (G, Mo). NUEVO LEON: 14 km. s. e. of Nuevo Laredo, on road to Monterey, *T. C. Frye & E. M. Frye 2395* (G). NEW MEXICO: Lea Co., Knowles, *Wooton*, July 29, 1909 (US; type of *A. perennis* Woot. & Standl.). TEXAS: Andrews Co., Andrews, *Parks & Cory 13836* (TAM). Bee Co., Pettus, *Tharp*, June 27, 1941 (G, Mo, SMU, T). Bexar Co., near Bracken, *B. H. A. Groth 119* (G); Leon Springs, *Mr. & Mrs. J. Clemens 1033* (Mo); 15 miles n.w. of San Antonio, *Sister Mary Clare 636* (C). Blanco Co., 5 miles w. of Round Mt., *Wolff 3824* (TAM); without locality, *Tharp 42–120* (G; same, without number, T). Burnet Co., 16 miles s.e. of Marble Falls, 2 miles s.e. of Spicewood, *Shinners 7242* (SMU). Childress Co., without locality, *Biology Class*, May-June 1930–1931 (T). Coke Co., Ft. Chadburn, *Cory 12448* (G, Mo); ¼ mile e. of Silver, *Cory 5312* (G, TAM). Comal Co., New Braunfels, *Lindheimer Exs. 414* (G, Mo), *Exs. 863* (G, Mo, T). Crockett Co., 25 miles w. of Ozona, *Forrest Shreve 9957* (SMU); without locality, *Tharp 43–882* (SMU, T). Crosby Co., Crosbyton, *Whitehouse 10396* (SMU); e. of Crosbyton, *Wolff 2002* (TAM). Dickens Co., Spur, *C. E. Fisher*, May 24, 1938 (TAM), Oct. 2, 1937 (USNA). Dimmit Co., Carrizo Springs, *Pauline Hoglund*, Aug. 29, 1931 (T). Duval Co., e. of Crestonia, *Robert Wagner & Fred A. Barkley 13949* (T). Edwards Co., Ranch Experiment Station, Pasture B, *Cory 3879* (TAM), Pasture D, *Cory 3534* (G), Pasture G, *Cory 37086* (G) (the Station lies on both sides of the Sutton-Edwards County line, south of Sonora). Frio Co., 2 miles n. of Pearsall, *Shinners 7421* (SMU); 5 miles n. of Pearsall, *Shinners 7422* (SMU). Garza Co., Post, *Whitehouse 10376* (SMU). Gillespie Co., Crab Apple Creek, *Herb. G. Jermy 303* (with pencil note, "probably from Waugh") (Mo); 4 miles n. of Fredericksburg, at Balanced Rock, *Whitehouse*, Aug. 14, 1931 (SMU). Goliad Co., n. of Goliad, *Eggert*, April 8, 1900 (Mo). Hall Co., Estelline, *Reverchon 4320* (Mo). Hays Co., Wimberley, *Mrs. Johnson*, Oct. 10, 1942 (T). Howard Co., n. of Big Spring, *Eggert*, June 11, 1900 (Mo). Jim Hogg Co., 30 miles s. of Hebbronville, *Tharp*, June 15, 1928 (T). Kendall Co., Comfort, *Dr. E. Palmer 521* in 1879 (Mo). Kent Co., 7 miles s.w. of Clairemont, *Parks & Cory 13698* (TAM), *13702* (USNA); 17 miles s.e. of Clairemont, *Shinners 8389* (SMU). Kerr Co., Kerrville, *Heller 1642* (C, G, Mo), *E. J. Palmer 10036* (Mo); between Ingram and Hunt on Highway 41, *Whitehouse 10571* (SMU). Kleberg Co., Kingsville, *Tracy 8926* (G, Mo, TAM). Live Oak Co., eastern part, Grant Ranch, *Tharp 42–118* (G); northern part, Randall Ranch, e. of Swinney Switch, *Whitehouse 10329* (SMU). Llano Co., Llano, *Bray*, May 9, 1899 (T). Lubbock Co., Lubbock City Farm, *Demaree 7729* (Mo), *7739* (C, G; pubescence ex-

ceptionally dense). Martin Co., 1½ miles n.e. of Stanton, *Cory 13909* (USNA). Medina Co., 1 mile e. of Hondo, *Shinners 7299* (SMU). Midland Co., Midland, *Parks & Cory 12491* (TAM), *Tracy 7874* (Mo, T). Mitchell Co., Colorado, *Eggert*, June 8, 1900 (Mo), n. of Colorado, *Eggert*, June 8, 1900 (Mo); Loraine, *I. O. Finley*, spring, 1927, (T); Mackenzie School, s.e. of Silver Creek (s.w. ¼ sec. 3, H&TCRR block 19), *Shinners 8398* (SMU); 5 miles s.s.e. of Spade Store, *Pohl 4341* (SMU). Motley Co., Roaring Springs, *Parks & Cory 16078* (TAM). Nolan Co., Sweetwater, *E. J. Palmer 30479* (Mo), *Tharp*, July 9, 1941 (T). Reagan Co., 10 miles n.w. of Stiles, *Cory 5277* (G). Scurry Co., 6 miles n. of Snyder, *Tharp*, July 9, 1941 (G, T). Sterling Co., without locality, *Tharp*, Sept. 2, 1925 (T). Sutton Co., 19 and ¾ miles s. of Sonora, *Cory 41482* (G, WV). Taylor Co., Camp Barkeley, *Tolstead 7233* (T, WV); Buffalo Gap Hills, *Cory 8770* (G); Sayles, *Parks & Cory 8768* (TAM), Sayles Ranch, *Cory 2566* (G). Tom Green Co., San Angelo, *Reverchon 4009* (Mo), *S. O. Matthews*, June, 1914 (Mo), *Bray*, May 19, 1899 (T). Travis Co., 26 miles n.w. of Austin, between Beecaves and Spicewood, *Shinners 7248* (SMU). Uvalde Co., Sabinal, *E. J. Palmer 11539* (Mo); w. of Uvalde, *M. E. Jones 18077* (C), 28022 (Mo). Val Verde Co., Del Rio, *M. E. Jones 25896* (Mo); 9¼ miles n. of Del Rio, *Parks & Cory 20847–48* (TAM).

EXCLUDED SPECIES

Aphanostephus pinulensis Coulter, Bot. Gaz. 16: 98. 1901. = *Chrysanthemum Parthenium* (L) Bernh. (type in U. S. National Herb., examined; see also note by Blake, 1937).

Keerlia linearifolia DC., Prodr. 5:310. 1836. = *Xanthocephalum linearifolium* (DC.) Greenman, Field Mus. Publ. Bot. 2: 345. 1912.

The species of Gray's genus *Keerlia*, *K. bellidifolia*, *K. effusa*, and *K. mexicana*, are more properly listed under *Chaetopappa* and *Astranthium*. They become respectively *C. bellidifolia* (Gray & Engelm.) Shinners, *C. effusa* (A. Gray) Shinners, and *Astranthium xylopodum* Larsen.

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REVISION OF THE GENUS KUHNIA L.

LLOYD H. SHINNERS

INTRODUCTION

The relationships of *Kuhnia* have twice been touched upon by the late Dr. B. L. Robinson (1913, 1917). Remarking on the absence of really satisfactory and strong characters to distinguish genera of the *Eupatorieae*, he places much reliance on the difference between the truly imbricated involucre of *Brickellia*, and the calyculate involucre of *Kuhnia*, in which the phyllaries are more or less distinctly in two groups. This is a very useful distinction, but by no means completely satisfactory. In some indubitable species of *Brickellia*, as for example *B. grandiflora* (Hook.) Nutt., the slender tips of the short outer phyllaries make them sufficiently unlike the inner to form nearly as recognizable a calyculum as that of *Kuhnia*. In the varieties *ozarkana* and *texana* of *Kuhnia eupatorioides* L., the elongate outer phyllaries make it almost impossible to distinguish a definite calyculum. A second major difference between the two genera is the conspicuously plumose pappus bristles of *Kuhnia*. But in the peculiar *K. adenolepis* Robinson, the bristles are not as conspicuously plumose as in the remaining species, while the small section *Steviastrum* of *Brickellia* is characterized by short-plumose rather than merely barbellate or scabrous pappus bristles. A further imperfect, though possibly the most reliable difference, is in the nature of the root system, which in *Kuhnia* normally consists of a single, vertical, conical, soft-woody root, with only very fine branches. In *Brickellia*, according to Dr. Robinson (1917, pp. 6–7), "the root is prevailingly of slender fibres, but in *B. grandiflora* it is of one or more elongated soft-woody fusiform-thickened fibres. . . . Short horizontal tuberous-thickened rootstocks . . . occur in *B. hymenochlaena* and *B. monocephala*. Branched and somewhat lignescent caudices are frequent in the genus."

The weak morphological characters of involucre, pappus, and root-system are strengthened by the obviously close relationship of the species of *Kuhnia* to each other, making a close-knit and recognizably distinct group. Somewhat more weight may then be given to the convenience of adhering to established usage (McVaugh, 1945), in particular of avoiding the unprofitable transfer of nearly 100 species of *Brickellia* to *Kuhnia* should the two be united, or else the conservation of Elliott's *Brickellia* (1822) against the Linnaean *Kuhnia* (1763), as well as against Cassini's *Coleosanthus* (1817) and in spite of Rafinesque's unrelated *Brickellia* (1808).

Most of the early work on this genus, both as to publication of new names and treatment of old ones, would have been better left undone. Excessive reliance was placed on plumose pappus and free anthers. Plumose

pappus is found in other genera, and sometimes, as in *Liatris*, is not the exclusive type in the genus; and as long ago noted by Cassini (1822), free anthers are occasionally found in a number of genera in several tribes of the COMPOSITAE. Mix-ups of garden and herbarium material led to much additional error. Arduin's *Eupatorium alternifolium* (renamed *Kuhnia altaica* by Rafinesque, with misleadingly altered description) was based on garden plants said to have been of Siberian origin, but from the illustration and technical characters, it is clearly the American *Kuhnia eupatorioides*, to which Gaertner and De Candolle referred it. Gaertner, after a single examination of florets from a plant sent him by Thunberg under the name of *Kuhnia eupatorioides*, found the anthers to be "pertinaciter connatae," and declared the Linnaean character of free anthers to be "plane fictitius." He therefore transferred the single species then known to Browne's West Indian genus *Critonia*, because of the plumose pappus. But as later noted by Cassini (1818), *Critonia* was merely a substitute name for *Dalea* Browne, which in turn was not figured with plumose pappus, though so described, and probably belonged to the VERNONIEAE. (It was retained by De Candolle in the EUPATORIEAE as "Critonia *P. Brown. jam.* (1756) *p.* 490. *non Gaertn. nec Cass.*") Ventenat's *Kuhnia rosmarinifolia* was described as a quite different plant from *Eupatorium canescens* Ortega, from seeds of which it was supposed to have been grown. Mere vegetative resemblance between cultivated plants of unknown identity and plants of Ventenat's *Kuhnia rosmarinifolia*, itself already of confused identity, was thought sufficient by Martius to base a new species of *Kuhnia* upon sterile material. Stephen Elliott, after accurately describing *Kuhnia glutinosa* in the proper genus, distributed under that name specimens of *Eupatorium altissimum* L. (so determined by W. J. Hooker, 1835, p. 96). De Candolle placed *Kuhnia glutinosa* Ell., with query and with altered description to fit the received specimen, under his sect. *Leiogonia*, including three species with merely barbellate pappus (the other two from Brazil), noted as "an potius Eupatorii species?" Later American authors assumed Elliott's species to be the same as *K. eupatorioides* var. *corymbulosa*, apparently because the name suggested the abundant resin dots so often characteristic of the involucre and undersurface of the leaves of the latter. The name was thus improperly used until Rydberg (1932) revived the correct synonym, *K. suaveolens* Fresenius.

SYSTEMATIC TREATMENT

KUHNIA L., Sp. Pl. (ed. 2) 2: 1662. 1763.

? *Kuhnia* subg. *Hemimphia* Raf., Herb. Raf. 30. 1833. (The type species, *K. tuberosa* Raf., is doubtfully *K. eupatorioides* var. *pyramidalis* Raf.)

Kuhnia sect. *Strigia* DC., Prodr. 5: 126. 1836.

COMPOSITAE, tribe EUPATORIEAE, subtribe KUHNIINAE (Robinson, Proc. Amer. Acad. 49 (also Contr. Gray Herb. n.s. 42): 437. 1913.)

Perennial herbs from a normally vertical, conical taproot which in age becomes stout and more or less soft-woody, with an irregularly divided

summit (but much subject to alterations of form in rocky or eroded ground). Stems one to many, simple or variously branched, erect to decumbent. Leaves unevenly alternate, or subopposite in widely separated groups of 2 or 3, or some of the lowest distinctly opposite. Inflorescence corymbose-paniculate, or the heads solitary or few and long-peduncled. Involucres subcylindric to turbinate or campanulate, of numerous separate chartaceous phyllaries which are apparently imbricated in 4–7 series, but those of the inner 2–4 series only slightly unequal and of different shape (linear or narrowly oblong or oblanceolate) from the shorter, lanceolate to deltoid, acute or acuminate, markedly unequal outer ones—the latter strictly speaking forming a calyculum about the proper involucre. Receptacle flat or slightly convex, naked but very shallowly alveolate. Heads homogamous, discoid, few- to many-flowered. Corollas tubular and nearly cylindrical, only slightly narrowed or somewhat constricted near the base, regularly 5-lobed at summit, creamy white to dull yellow or red. Styles forking below the base of the corolla lobes, the two branches with slender, flattened, 1-nerved basal half or two thirds, and thickened, darker, terminal third or half, the clavate tips conspicuously exserted in flower in advance of the dehiscence of the anthers; base of the style with a collar-like, bulbous, woolly-pubescent enlargement. Anthers coherent, at least at base or at least when young, but readily separating and commonly partly or wholly free at flowering time, the tips with a prominent, rounded-triangular, hyaline appendage about 0.3 mm. long, the bases rounded or bluntly pointed. Achenes columnar or slightly clavate, 10-ribbed (sometimes apparently 15- or 20-ribbed), carunculate at base. Pappus of 10, 15, or 20 equal, uniseriate, plumose bristles, slightly shorter to slightly longer than the corollas.

Dry-ground plants, especially of rocky or sandy soil, of the United States and Mexico, from Pueblo, Michoacan, and Jalisco to Arizona, Utah, Montana, Minnesota, Ohio, New Jersey, and Florida. The northern plants flower in late summer or fall, the southern rather erratically at almost any season, depending on rainfall rather than temperature or day length.

Type species: *K. eupatorioides* L.

KEY TO THE UNITED STATES SPECIES OF KUHNIA

1. Stem leaves all narrowly linear and entire, not over 3 mm. wide.....2.
   2. Heads 15–35-flowered; plants of the Southwest.....3.
      3. Leaves narrowly linear, 0.5–1.0 mm. wide, very numerous and crowded, the upper little reduced; inflorescence normally cylindrical, the stems simple up to the narrow inflorescence; plants of gravel bars and flats along streams in and near the southeastern margin of the Edwards Plateau, south central Texas.....2. *K. leptophylla.*
      3. Leaves linear to lanceolate, the larger 1–3 (–8.5) mm. wide, scattered, the upper considerably smaller; plants usually

much branched, the inflorescence broad and open; plants of west Texas to Arizona, Utah, and Colorado. . 3. *K. chlorolepis.*

2. Heads 9–13-flowered; plants of lower peninsular Florida. . . . . 5. *K. Mosieri.*

1. Stem leaves linear-lanceolate to broadly rhombic, at least the middle and lower more than 3 mm. wide. . . . . 4.

4. Leaves sessile or subsessile, entire or rarely with a single pair of prominent teeth near the base, the larger blades 1.5–8.5 mm. wide; heads solitary or in loose clusters of 2–5, on peduncles or branchlets 0.5–3.0 or occasionally as much as 12 cm. long; plants of the Southwest, Utah and Colorado to western Texas and Arizona (intermediates with *K. eupatorioides* var. *corymbulosa* occur in eastern Colorado, northwestern Texas, and adjacent New Mexico). . . . . 3. *K. chlorolepis.*

4. Leaves subsessile or short-petioled, the petioles up to 1 cm. long, the blades entire or coarsely and deeply toothed, the larger 5–45 mm. wide; heads mostly in rather dense clusters of 3–8, on peduncles 0.3–2.0 cm. long, or a few solitary or in pairs, on peduncles as much as 4 cm. long; plants of central and eastern United States (Montana, Colorado, extreme northeastern New Mexico, and Texas to Florida, New Jersey, Ohio, and Minnesota). . . . . 5.

5. Middle and outer (calyculate) phyllaries acute or acuminate, usually all considerably less than ¾ as long as the inner, and erect and appressed (tips very slender and loose in occasional forms of *K. eupatorioides* var. *corymbulosa* in the Middle West). . . . . 6.

6. Heads 7–14-flowered; involucres 7.0–10.5 mm. high; plants of the southeastern United States (New Jersey to southern Indiana, southeastern Texas, and Florida. . . . . 6a. *K. eupatorioides* var. *pyramidalis.*

6. Heads 14–33-flowered; involucres 8.7–14.0 mm. high; plants of the prairies and plains (western Ohio to Montana, Colorado, extreme northeastern New Mexico, and central Texas). . . 6d. *K. eupatorioides* var. *corymbulosa.*

5. Middle and outer phyllaries with conspicuous, elongate, falcate or twisted, filiform tips, usually at least some of them from ¾ to fully as long as the inner. . . . . 7.

7. Heads 10–14-flowered; plants of the Ozark region, southern Illinois, Missouri, and Arkansas (intermediates between this and var. *corymbulosa* in Arkansas and Missouri simulate var. *texana*). . . . 6b. *K. eupatorioides* var. *ozarkana.*

7. Heads 18–33-flowered; plants of central and northern Texas and Oklahoma. . 6c. *K. eupatorioides* var. *texana.*

KEY TO THE MEXICAN SPECIES OF KUHNIA

Because of the considerable overlap in detailed characters of involucres and florets, and in geographic range, general features of habit must often be relied upon in identification. Unfortunately, most of the Mexican col-

lections, except some made in recent years, are fragmentary; and information regarding flower color and habitat, which might have been very helpful, is lacking. A few specimens could not be named at all, and a number of others were named only with considerable misgivings. Typical complete specimens of *K. chlorolepis* and *K. oreithales* look different enough, but it is impossible to find any really satisfactory distinguishing characters, at least that can be used with the general run of available material. Plants of *K. chlorolepis* with damaged growing point may put forth basal shoots with leaves nearly as large as those of *K. oreithales*. Repeatedly browsed or trampled plants conversely may produce many short branches with very small leaves like those of *K. microphylla*. Fragments from such plants, with no explanatory information, are worse than useless; they are extremely misleading, and are a major source of difficulty for the taxonomist. The following key is offered with considerable reluctance as an outline of the more prominent distinguishing features in those specimens which could be named with some degree of assurance. A number of others could not be taken into account without entirely obscuring characters which clearly do exist.

1. Plants 10–30 cm. tall, the stem leaves linear and nearly uniform in shape and size (10–24 mm. long, 1–2 mm. wide); heads relatively large for the size of the plant, the involucres 8.8–11.2 mm. high, the corollas 7.2–8.2 mm. long; plants of central and southern Mexico.....1. *K. microphylla*.

1. Plants normally 30–100 cm. or more tall, the leaves of well developed stems linear to lanceolate, up to 10 cm. long and 18 mm. wide (stem and leaves showing extreme variation due to drought, erosion, grazing, trampling, mowing, insect damage, and other extraneous factors); involucres 8–14 mm. tall, corollas about 6.3–8.0 mm. long; plants chiefly of central and northern, doubtfully of southern Mexico.....2.

2. Stem leaves rather uniform in size, very numerous, narrowly linear (up to 4.5 cm. long, 1.5 or occasionally 2 mm. wide), curled or twisted; inflorescence elongate-pyramidal or cylindrical, rather dense..... .....2b. *K. leptophylla* var. *mexicana*.

2. Stem leaves fewer, the upper usually decidedly smaller, the blades not curled or twisted, linear to lanceolate, the largest 2.5–10.0 cm. long, 1.5–18.0 mm. wide; inflorescence usually loose and open, generally broad.....3.

3. Outer phyllaries narrowly deltoid-lanceolate, about 0.6–1.3 mm. wide, the middle and inner obtuse, abruptly acute, or apiculate; corollas about 6.3–7.5 mm. long; leaves membranous, linear to lanceolate, entire or with a single prominent basal tooth or pair of teeth.....4.

4. Largest leaves of normal stems 2.5–5.5 cm. long; involucres 8.0–11.7 mm. high, corollas 6.3–7.5 mm. long, achenes 4.8–5.2 mm. long; well developed plants inclined to be bushy-branched.....3. *K. chlorolepis*.

4. Largest leaves of normal stems 5–10 cm. long; involucres 9.7–12.0 mm. high, corollas about 7.5 mm. long, achenes

about 6 mm. long; plants usually with few, virgately ascending, nearly simple branches in the upper half.... .....4. *K. oreithales.*

3. Outer phyllaries oblong-oval, about 1.3–1.5 mm. wide, the middle and inner abruptly acute and with a prominent short spine-tip; corollas about 8 mm. long; leaves slightly coriaceous, lanceolate with broad base, serrate or entire..7. *K. adenolepis.*

1. **Kuhnia microphylla** Shinners, sp. nov.

Planta humilis (usque ad 30 cm. alta) gracilis; folia parva conformia linearia integra, 10–15 (–24) mm. longa, 1(–2) mm. lata. Capitula solitaria pedunculos saepe subnudos terminantia. Involucra 8.8–11.2 mm. alta, 15–22-flora. Corollae 7.8–8.2 mm. longae, achaenia 5.2–5.8 mm., pappi setae 5.5–6.0 mm.

Stems 10–30 cm. tall, slender, brittle, virgately branched, minutely strigose. Stem leaves nearly uniform in shape and size, linear, entire, 10–15 (–24) mm. long, 1(–2) mm. wide, those of branches or peduncles gradually smaller, glabrous or puberulent, punctate beneath and less distinctly so above. Heads solitary and terminal on branches or often nearly naked peduncles up to 10 cm. long. Involucres 8.8–11.2 mm. tall, with 15–22 florets. Phyllaries prominently striate or ribbed, glabrous or softly pubescent, the middle and inner linear or narrowly oblong, abruptly acute or apiculate. Corollas 7.2–8.2 mm. long, the lanceolate lobes about 0.6 mm. long. Achenes black-brown, 15-ribbed, pubescent, at least toward summit, 5.2–5.8 mm. long. Pappus bristles 20, flattened and strongly plumose, white with yellow brown base or wholly brown, 5.5–6.0 mm. long.

The type was collected at Forte de Lorette, vicinity of Puebla, state of Puebla, Mexico, by Brother Nicolas, no. 5932, August 8, 1911 (in Gray Herb.; isotype in herb. University of Illinois).

The type sheet of *Kuhnia Schaffneri* A. Gray contains two small but quite adequate plants (including the summit of the plainly non-bulbous root), apparently representing a damaged growth form of *K. microphylla* having a few basal shoots from broken (perhaps browsed) stems with short-oblong leaves, and secondary simple, nearly leafless, monocephalous stems, mounted with fragments from some unknown woody-bulbous plant, probably a legume (possibly a *Hoffmannseggia* or *Psoralea*). The latter were emphasized in Gray's description as an important characteristic of the species, and the name *Kuhnia Schaffneri*, being based on a mixture, must be rejected.

Some additional specimens examined: HIDALGO: near El Salto, *C. G. Pringle 9932, 11545* (G). "Prope Huejutla," *O. Hoffman 623* (G). Jacala Municipality, *V. H. Chase 7231* (G). MICHOACAN: Morelia, "route de Mexico," *Brother G. Arsène 9012* (G). Vicinity of Morelia, Punguato, *Bro. Arsène 5824* (G, Ill; doubtfully this). PUEBLA: "Guadeloupe," *Brother Nicolas 58* (G). SAN LUIS POTOSI: "Prope Tlascala," *J. G. Schaffner 371* (G).

2. KUHNIA LEPTOPHYLLA Scheele, Linnaea 21: 598. 1848.

K. eupatorioides var. *gracillima* A. Gray, Plantae Lindheimerianae II (Boston Journ. Nat. Hist. 6): 218. 1850.
K. rosmarinifolia Vent. var. *gracillima* (A. Gray) Blankinship, Plantae Lindheimerianae III (Ann. Rept. Mo. Bot. Gard. 18): 178. 1907.

Stems 20–70 cm. or more tall, striate, minutely scabrous-pubescent (sparsely so below), normally simple to the inflorescence which occupies the terminal third or less. Leaves very numerous, spirally scattered, often with axillary fascicles, sessile, the upper little reduced; the narrowly linear blades up to 5 cm. long and 1 mm. wide, entire and with revolute margins, scabrous above, punctate beneath, falcate or twisted. Inflorescence typically elongate-pyramidal or cylindrical, the relatively short ascending branches with numerous very small leafy bracts about 8–12 mm. long. Heads solitary or loosely clustered. Involucres 7.8–9.0 mm. high, with 17–25 florets. Phyllaries rather thin, linear, pubescent or nearly glabrous, the middle and inner abruptly mucronate or cuspidate. Corollas about 6.3 mm. long, with narrowly oblong, obtuse lobes about 0.6 mm. long, yellowish or reddish. Achenes columnar, black-brown, glabrous or sparsely pubescent toward summit, 10-striate, 5–6 mm. long. Pappus conspicuously plumose, brown, 4.5–5.5 mm. long.

A localized species of gravelly river beds (limestone) in and near the southeastern margin of the Edwards Plateau, from Travis and Gillespie to Uvalde and Bexar counties, south-central Texas.

The type was collected in the dry bed of the Cibolo River, 15 miles from New Braunfels, on the boundary between present Bexar and Comal counties, Texas, by F. J. Lindheimer, in October, probably in 1846. The type collection of *K. eupatorioides* var. *gracillima*, which according to the field label was collected at the same locality Oct. 6, 1846, is probably part of the same collection seen by Scheele.

Some additional specimens examined: TEXAS: Bexar or Comal Co., Cibolo River, *Lindheimer Fl. Tex. Exs. 411* (type of *K. eupatorioides* var. *gracillima*, G; isotypes C, Mo, P; all these probably are also isotypes of *K. leptophylla*). Blanco or Gillespie Co., upper Piedernales River, *Lindheimer 433* (field no.) (G). Gillespie Co., $14\frac{1}{4}$ miles s.w. of Kerrville, *H. B. Parks & V. L. Cory 24929* (TAM). Kimble Co., Junction, *Eula Whitehouse*, Nov. 11, 1932 (T). Travis Co., Austin, *R. H. Painter*, Oct. 10, 1923 (T). Uvalde Co., Montell, *E. J. Palmer 12982* (C, Mo, RM); Utopia, *Palmer 12944* (C, RM). Zavalla Co., Nueces River, $11\frac{1}{2}$ miles s. of Uvalde, *Parks & Cory 11966–11968* (TAM).

2b. KUHNIA LEPTOPHYLLA var. **mexicana** Shinners, var. nov.

A specie differt aspectu robustiore, sed foliis brevioribus (ad 4.5 cm. longis); capitulis majoribus, involucris 8.7–11.0 mm. altis.

Resembling the species, but coarser in all parts. Stems stouter and probably taller (only incomplete specimens seen), with longer but still narrow inflorescence; leaves appearing coarser, but averaging shorter (up to 4.5

cm. long) and slightly wider (1.5 or occasionally 2 mm.). Involucres 8.7–11.0 mm. high, with 22–27 florets.

The type was collected by Dr. Edward Palmer "at the city of Durango and vicinity," no. 935 of the 1896 series (in Gray Herb.; isotypes in herb. University of California and Missouri Botanical Garden). Known also from the following collections:

DURANGO: Durango and vicinity, *Dr. E. Palmer 568, 569, 934* in 1896 (C, G, Mo), *936* (C, G).

The following are doubtfully placed here, though some of the duplicates appear more like *K. chlorolepis* (all are unfortunately fragmentary):

CHIHUAHUA: rocky hills near Chihuahua, *Pringle 649* (C, D, G, Mo). DURANGO: Durango and vicinity, *Palmer 284* in 1896 (C, G), *937* (G). NEW MEXICO: without locality, *Charles Wright 1133* in 1851 (C, G, Mo).

3. KUHNIA CHLOROLEPIS Wooton & Standley, Contr. U. S. Nat. Herb. 16: 177. 1913.

K. rosmarinifolia Vent. var. *chlorolepis* (Woot. & Standl.) Blake, Journ. Wash. Acad. Sci. 30: 467. 1940.

This species has generally been known by the name *Kuhnia rosmarinifolia* Ventenat (see list of excluded species at the end). The name "Kuhnia rupestris Greene n. sp." appears on printed exsiccatae labels of O. B. Metcalfe no. 152, collected in the Gila River bottom near Cliff, Grant Co., New Mexico, June 15, 1903, but the species was never formally published.

Stems 30–75 cm. tall, usually bushy-branched in the upper third or nearly from the base, minutely pubescent. Stem leaves sessile or subsessile, linear or narrowly oblong to lanceolate, entire or very rarely with a basal pair of salient teeth, green and scabrous above, paler, punctate and glabrous except on the veins beneath, 1- or the larger 3-nerved; middle and lower leaf blades 2.5–5.5 cm. long (occasionally up to 7.5 cm. on leafy shoots from injured plants, or merely 1–2 cm. on stunted branches from much browsed plants), 1.5–8.5 mm. wide. Inflorescence loose and open, the heads solitary and terminal on the branchlets, or in small loose clusters of 2–5, erect or possibly slightly nodding before maturity. Peduncles 5–30 mm. long (or solitary heads occasionally terminating branches as much as 12 cm. long), naked or with few much reduced bracts. Involucres 8.0–11.7 mm. high, with 15–34 florets. Phyllaries rather thin, striate, nearly glabrous or softly pubescent, linear to oblong or oblong-lanceolate, obtuse and apiculate. Corollas about 6.3–7.5 mm. long, the lobes 0.3–0.5 mm. long, creamy white to yellowish or reddish. Achenes about 4.8–5.2 mm. long, black-brown, sparingly pubescent. Pappus bristles 5.0–6.3 mm. long.

A common, widespread, highly variable species of the Southwest and northern Mexico, doubtfully as far south as Michoacan.

The type was collected at Mangas Springs, Grant Co., New Mexico, by O. B. Metcalfe, no. 104, June 2, 1903 (in U. S. National Herbarium, not seen; isotypes in herb. University of California and Dudley Herbarium).

Some additional specimens examined: CHIHUAHUA: vicinity of Chihuahua, *Dr. E. Palmer 183* in 1908 (G); near Chihuahua, *Pringle 649* (C, G; this or *K. leptophylla* var. *mexicana*); n. of Chihuahua, *Harde LeSueur*, July 25, 1936 (T). Chuhuichupa, *LeSueur*, Aug.-Sept., 1936 (T). Colonia Diaz, *E. W. Nelson 6460* (G). District of Guerrero, w. of Miñaca, *Ynes Mexia 2576* (C, G, P); 8 miles n. of Santo Tomas, *C. H. Muller 3392* (G, SMU). Majalca, *LeSueur*, Aug. 20, 1935 (T). COAHUILA: Cerro de Cypriano, *C. A. Purpus 4462* (C; one of the several fragments mounted on the same sheet has peculiar, stiff, cuspidate bracts on the peduncles). General Cepida, *Nelson 6720* (G). Municipio de Muzquiz, near Puerta Santa Anna, *F. Lyle Wynd & C. H. Mueller 275* (G); Muzquiz, Yerda Spring, *Ernest G. Marsh Jr.*, July 6, 1936 (T). Saltillo and vicinity, *Palmer 142* in 1898 (C, G), *454* in 1880 (G); 6 miles e. of Saltillo, *Palmer 456* in 1880 (P). Sierra de Parros, *Purpus 4717* (C). Sierra Prieta, *Purpus 4662* (C, G). DURANGO: Tepehuanes, *Palmer 318* in 1906 (C, G). (See also specimens doubtfully cited under *K. leptophylla* var. *mexicana*.) MICHOACAN: vicinity of Morelia, "vers La Huerta," *Bro. Arsène 5127* (G; doubtfully this). NUEVO LEON: Municipio de Derrumbadero, above San Enrique, *C. H. Mueller 2406* (G). SAN LUIS POTOSI: Charcas, *C. L. Lundell 5293* (C, D). San Luis Potosi, *C. C. Parry & Dr. E. Palmer 364* in 1878 (G); "circa urbem," *Schaffner 291* (G). SONORA: District of Alamos, Arroyo del Agua Blanco, *H. S. Gentry 503* (D). Between Balocomori and Santa Cruz, *Geo. Thurber 1010* (G). Santa Cruz, *C. Wright 1137* (P). ZACATECAS: 14 miles s. of Santa Maria de Banon, *I. M. Johnston 7443* (G). ARIZONA: Cochise Co., Chiricahua Mts., 5 miles s. of Dos Cabezas, *Witmer Stone 180* (P); e. of Douglas, *Leslie N. Goodding 2278* (C, G, RM). Coconino Co., Flagstaff, *M. E. Jones 4103* (C, D, P, RM). Greenlee Co., Blue River, *Clifton A. Davidson 719* (D, G). Pima Co., Manning Camp, Rincon Mts., *J. C. Blumer 3404* (D, G). COLORADO: Archuleta Co., Piedra, *C. F. Baker 752* (C, D); Johnson Sawmill, Piedra, *Hazel M. Schmoll 1482* (C, RM); Pagosa Springs, *Baker 690* (G, RM). Chaffee Co., Salida, *G. E. Osterhout 3428* (RM). Conejos Co., Romeo, *Francis Ramaley*, Aug. 9, 1930 (RM). Delta Co., Hotchkiss, *J. H. Cowen 2979* (RM). El Paso Co., Cascade, *I. W. Clokey 3312* (C-Cl, D, G, Ill). Fremont Co., Tp. 20, Range 20, *T. S. Brandegee* in 1872 (C). Huerfano Co., Cucharas Valley near La Veta, *F. K. Vreeland 667* (RM). La Plata Co., Durango, *C. F. Baker, S. F. Earle & S. M. Tracy 535* (R, RM). Larimer Co., Canon of the Thompson, near the forks, *Osterhout 3626* (RM). Las Animas Co., foot of Raton Pass near Morley, *Roxana A. Ferris & Carl D. Duncan 3575* (D). Montezuma Co., 8 miles e. of Cortez, *Marion Ownbey 1463* (C, G, RM). Montrose Co., Naturita, *E. B. Payson 606* (D, G, P, RM). Ouray Co., 1 mile n. of Ridgway, *Bassett Maguire 12665* (G). NEW MEXICO: Catron Co., 15 miles n.e. of Mogollon, *C. L. Hitchcock, Roland V. Rethke & R. van Raadshoven 4460* (C, D, G). Dona Ana Co., Dripping Springs, Organ Mts., *W. A. Archer 7350* (C-Cl). Grant Co., Gila River bottom near Cliff, *Metcalfe 152* (C-Cl, D, RM). Lincoln Co., Gray, *F. S. Earle & Esther S. Earle 404, 406* (RM). San Miguel Co., Las Vegas Trout Spring, *Bro. Arsène 20952* (C); near Pecos, *P. C. Standley 5162* (G, RM). Sierra Co., s. end of Black Range, *Metcalfe 1154* (C-Cl). Socorro Co., Mogollon Mts., *Metcalfe 590* (C-Cl, RM). TEXAS: Brewster Co., Alpine, *Barton H. Warnock*, Aug. 13, 1937 (G). Culberson Co., s. of Lobo, *U. T. Waterfall 4779* (G). El Paso Co., Hueco Tanks, *Eula Whitehouse*, Nov. 17, 1931 (T). Jeff Davis Co., Low Goat Canyon, Davis Mts., *L. C. Hinckley 873* (G); 14¾ miles e. of Valen-

tine, *Cory 40374* (G). Pecos Co., without locality, *B. C. Tharp 43–878* (RM, SMU, T). Presidio Co., 26 miles e. of Marfa, *Cory 3520* (G); near Vieja, *Hinckley 2180* (SMU). Sutton Co., Angela Draw, Sonora, *Cory 43478* (G). Val Verde Co., Del Rio, *E. J. Palmer 12355* (C, Mo).

The following specimens represent intermediates between *K. chlorolepis* and *K. eupatorioides* var. *corymbulosa:*

COLORADO: Denver Co., Barnum, *Alice Eastwood 114* (C, G), *115* (G). El Paso Co., Manitou, *F. E. Clements & E. S. Clements*, Sept. 12, 1901 (G).

The following could not be positively identified, but probably are nearest *K. chlorolepis:*

TEXAS: Sutton Co., Sonora, *Cory*, Oct. 26, 1925 (TAM). Tom Green Co., South Concho River at Christoval, *Cory 5057* (G).

4. KUHNIA OREITHALES Robinson, Proc. Amer. Acad. 54 (also Contr. Gray Herb. n.s. 55): 263. 1918.

K. triplinervis Blake, Contr. U. S. Nat. Herb. 22: 591. 1924.

Stems 40–65 cm. or more tall, striate, green or stramineous to red brown, finely pubescent. Branches usually few in the upper third or half of the plant, virgately ascending, long and slender, simple or nearly so, with few leafy bracts. Leaves sessile or subsessile, entire, linear-lanceolate to broadly lanceolate, glabrous or minutely scabrous above, minutely pubescent on the veins and obscurely though densely punctate beneath, the largest ones (just below the middle of the stem) 5–10 cm. long, 3.5–9 (–18) mm. wide. Heads solitary or few on long slender peduncles, nodding before maturity; involucres yellow green to dark purple, 9.7–12.0 mm. high, with 16–26 florets. Phyllaries rather densely ciliate with soft hairs, more or less pubescent on the back and striate, the middle and inner linear and acute or apiculate. Corollas about 7.5 mm. long, achenes about 6 mm., pappus bristles 5.5–7.0 mm.

The type was collected near Colonia Garcia, Chihuahua, Mexico, by C. H. T. Townsend and C. M. Barber, no. 260, August 16, 1899 (in Gray Herb.; isotypes in herb. University of California and herb. Missouri Botanical Garden).

Some additional specimens examined: CHIHUAHUA: Carretas, border of Chihuahua and Sonora, Municipio de Janos, *S. S. White 2581* (G). Casas Grandes, *E. A. Goldman 404* (G; probably this). Chuhuichupa, *LeSueur 958* (G). Near Colonia Garcia in the Sierra Madre, *E. Nelson 6208, 6216* (G). Near Colonia Juarez, foothills of the Sierra Madre, *Nelson 6236* (G; probably this). Fifteen miles s. of Guadalupe y Calvo, *Nelson 4825* (G; isotype of *K. triplinervis* Blake, an exceptionally broad-leaved form). Memilichi, Rio Mayo, *Gentry 2767* (C, G). Near Parral, *Goldman 124* (G); Parral to Batopsis, *Goldman 164* (G). DURANGO: near La Providencia, Sierra Madre and Sierra Santa Barbara, *Nelson 5016* (G). NUEVO LEON: upper west slope of the Sierra de la Cebolla, Municipio de Rayones, *C. H. Muller 2903* (G). SONORA: San Pedro, *C. V. Hartman 841* (G).

5. KUHNIA MOSIERI Small, Man. S. E. Fl. 1329 and 1508. 1933.

The name "Kuhnia rosemariaefolia Small," probably an error for *Kuhnia rosmarinifolia* Vent., appears on printed exsiccatae labels of S. M. Tracy, Plants of the Gulf States no. 9046, Miami, Florida, May 13, 1904.

Stems 45–70 cm. tall, usually 1 or several flowering ones with several sterile leafy shoots, striate, minutely and rather densely appressed pubescent, normally simple to the inflorescence which occupies the terminal tenth to fourth of the plant. Leaves linear or narrowly oblong, entire, scabrous-pubescent and more or less resin-dotted above, glabrous and densely resin-dotted beneath, the lower widely spreading to reflexed, the largest 2–4 cm. long, 1–3 mm. wide, the upper gradually smaller, spreading to ascending. Inflorescence corymbose or corymbose-paniculate, nearly flat-topped to pyramidal; primary branches simple or once forked, the ultimate branchlets or peduncles 1–6 cm. long at flowering time, naked or with few much reduced leafy bracts 0.5–4.0 mm. long. Heads solitary; involucres 8.5–10.5 mm. high, with 9–13 florets. Corollas 6.0–6.5 mm. long, the lobes about 0.3 mm. long. Achenes 3.5–4.7 mm. long, dark brown or black-brown, columnar or slightly clavate, 10-ribbed, minutely hispidulous on the ribs. Pappus bristles 20, strongly plumose, brown, 5.5–6.5 mm. long.

A highly restricted endemic, known from a small area in southeastern Florida. The doubtful report of this species from as far west as southern Alabama was probably based on fragmentary specimens of slender plants of *K. eupatorioides* var. *pyramidalis;* without stem leaves, the two are practically indistinguishable.

The type was collected on Ross-Costello Hammock, Dade Co., Florida, by Small, Mosier & Small, no. 6544 (in herb. New York Botanical Garden; not seen).

Some specimens examined: FLORIDA: Dade Co., Miami, *J. J. Carter & J. K. Small 1075* (P); same locality, *S. M. Tracy 9046* (G, Mo); between Biscayne Bay and the Everglades, *A. H. Curtiss, N. Amer. Pl. 1187* (G; apparently the same, without number, P); Camp Jackson, *Small & Carter 106* (P); Hunting Ground, Biscayne Bay, *Curtiss, Pl. of So. U. S. 5493* (C, G, Ill, Mo); Aspalaga, *Biltmore Herb. duplicates of Chapman Herb. 2627a* (G).

6. KUHNIA EUPATORIOIDES L., Sp. Pl. (ed. 2) 2: 1662. 1763.

The most widespread and abundant species, occurring entirely within the United States, in four well defined geographic varieties.

6a. KUHNIA EUPATORIOIDES var. PYRAMIDALIS Raf., New Fl. N. A. 1: 78. 1836.

Kuhnia eupatorioides L., Sp. Pl. (ed. 2) 2: 1662. 1763. (In appendix; attributed to "L. f." by most early writers, though this does not appear on the title page.)

Eupatorium alternifolium Arduinus, Animadversiones Botanicae XL. *Tab. 20.* 1764. (Based on a garden plant erroneously said to be of Siberian origin.)

Critonia Kuhnia Gaertn., De Fructibus et Seminibus Plantarum 2: 411. 1791. (As to name on which based, *Kuhnia eupatorioides* L.; but possibly not as to plant described and figured.)
Kuhnia Critonia Willd., Sp. Pl. vol. 3, pt. 3: 1773. 1803.
Kuhnia paniculata Cass., Dict. Sci. Nat. 24: 516–517. 1822.
Kuhnia glutinosa Ell., Sketch of the Botany of S. C. & Ga. 2: 516–517. 1822? (dated 1824).
Kuhnia dasypia Raf., Herb. Raf. 30. 1833. (Republished as new in New Fl. N. A. 1: 79. 1836.)
Kuhnia elliptica Raf., Herb. Raf. 29. 1833.
Kuhnia glabra Raf., Herb. Raf. 29. 1833.
Kuhnia lineana Raf., Herb. Raf. 29. 1833. (As synonym of or alternate name for *K. pubescens*.)
Kuhnia media Raf., Herb. Raf. 30. 1833.
Kuhnia paniculata Raf., Herb. Raf. 30. 1833 (As synonym of or alternate name for *K. pubescens*.)
Kuhnia pubescens Raf., Herb. Raf. 30. 1833.
Kuhnia tuberosa Raf., Herb. Raf. 30. 1833 (Said to be based on the *Kuhnia Critonia* of Elliott; tuberous root and reflexed outer phyllaries suggest Rafinesque's own plant may not have been *Kuhnia*, but his descriptions are not always very accurate.)
Kuhnia altaica Raf., New Fl. N. A. 1: 79. 1836. (Based on *Eupatorium alternifolium* Ard., but the plant erroneously described as having decurrent leaves.)
Kuhnia elliptica var. *montana* Raf., New Fl. N. A. 1: 79. 1836. (Nomen nudum, but apparently partly intended as a new name for *K. glabra*.)
Kuhnia eupatorioides var. *augustifolia* Raf., New Fl. N. A. 1: 79. 1836.
Kuhnia eupatorioides var. *corymbosa* Raf., New Fl. N. A. 1: 78. 1836.
Kuhnia fulva Raf., New Fl. N. A. 1: 80. 1836. (New name for *K. media*.)
Kuhnia albicaulis Raf., New Fl. N. A. 4: 105. 1838 (dated 1836).
Kuhnia cinerea Raf., New Fl. N. A. 4: 106. 1838 (dated 1836).
Kuhnia divaricata Raf., New Fl. N. A. 4: 105. 1838 (dated 1836).
Kuhnia glomerata Raf., New Fl. N. A. 4: 105. 1838 (dated 1836).
Kuhnia latifolia Raf., New Fl. N. A. 4: 105. 1838 (dated 1836).
Kuhnia virgata Raf., New Fl. N. A. 4: 105. 1838 (dated 1836).
Kuhnia eupatorioides var. *gracilis* T. & G., Fl. N. A. 2: 78. 1841.
Kuhnia eupatorioides var. *glutinosa* (Ell.) Hitchc., Trans. St. Louis Acad. 5: 498. 1891 (As to name on which based, *Kuhnia glutinosa* Ell., but the new combination was applied to *K. eupatorioides* var. *corymbulosa* T. & G.)
Kuhnia Kuhnia (Gaertn.) Mohr, Bull. Torr. Bot. Club 24: 28. 1897.

Stems solitary or few, 40–130 cm. tall, erect, striate, minutely appressed pubescent, green to purple brown, normally simple to the inflorescence which occupies the terminal third of the plant or less, with 35–65 leaves below the inflorescence. Stem leaves usually rather thin, narrowly lanceolate to broadly rhombic-lanceolate (the lowest broadest and short, those just above narrower and longer, the upper gradually smaller), the largest 2.5–10 cm. long, 0.5 4.0 cm. wide; dark green, minutely scabrous, and more or less resin dotted above, paler, reticulate-veiny, puberulent on the veins or sparingly over the surface (densely so in a single exceptional Ten-

nessee collection), and copiously resin-dotted beneath; margins entire to sparingly and shallowly dentate, or less often rather coarsely and deeply dentate. Petioles of lower leaves up to 1 cm. long. Inflorescence corymbose-paniculate, rather loose and open, the branches spreading-ascending, with linear or linear-lanceolate sessile or short-petioled bracts 0.5–2.5 cm. long. Heads corymbosely clustered on peduncles 0.3–2.0 cm. long, rarely solitary and terminal on branchlets as much as 4 cm. long. Involucres 7.0–10.5 mm. high, with 7–14 florets. Phyllaries in about 4 series, striate, hirsutulous, more or less resin-dotted; the outer subulate-deltoid to lanceolate, the inner narrowly oblanceolate to narrowly linear, 0.6–1.1 mm. wide. Corollas creamy or yellowish, 4.5–5.8 mm. long, the oblong or bluntly triangular lobes 0.3–0.5 mm. long. Achenes glabrous or minutely pubescent, 10-striate, 4.5–5.2 mm. long. Pappus bristles 20, white to muddy brown, 4.5–5.5 mm. long.

Rocky or sandy open ground or open woods, New Jersey to southern Indiana, southeastern Texas, and Florida. Plants of the outer Coastal Plain, especially from the Carolinas to Mississippi, tend to be more slender, with narrow leaves and loose, few-flowered inflorescences, but are hardly to be distinguished formally from the generally stouter and broader-leaved plants of the interior. The names *Kuhnia paniculata* Cass. and *K. eupatorioides* var. *gracilis* T. & G. were applied to the slender form.

The type was probably a garden plant; it was said to have been brought living from Pennsylvania by Adam Kuhn, of Philadelphia. Rafinesque later found *Kuhnia eupatorioides* on "rocky banks of the R. Schuylkill near Philadelphia, in a single spot near the railroad bridge" (New Fl. N. A. 1: 78), and described three varieties of it: 1. *pyramidalis*, 2. *corymbosa*, 3. *angustifolia*. He noted that "these 2 last are probably the *Critonia* of Gaertner & others, yet they are perhaps nothing else but various ages of the plant? but since they have been mistaken for species, they must be properly noticed." Thus could the conservative field botanist correct the faulty conception of species of the closet botanists. Unfortunately his own work did not receive the same critical attention.

Some specimens examined: ALABAMA: Lee Co., Auburn, *Earle & Earle, Plants of Ala. 93* (G, RM). Mobile Co., Mobile, *C. Mohr*, Oct. 1878 (D). Without locality, *Gates* (G; selected as type of *K. eupatorioides* var. *gracilis* T. & G.). DISTRICT OF COLUMBIA: near Terra Cotta, *Theo. Holm*, Sept. 20, 1898 (Ill). FLORIDA: "Middle Florida," *Chapman Herb.* (G). GEORGIA: Tallulah Falls, *T. C. P.*, Sept., 1846 (D). Wrightsborough (?Wrightsville in Johnson Co.), *Chapman Herb.* (Mo). Without locality, *Herb. C. W. Short* (G; mounted on same sheet with fragment of var. *corymbulosa* having no other label). INDIANA: Clarke Co., Forest Reserve, *C. C. Deam 23803* (G). Greene Co., 5 miles s.e. of Lyons, *Deam 24704* (G). Harrison Co., about 3 miles e. of Elisabeth, *Deam 22436, 24375, 26233* (G). Jefferson Co., about 1 mile w. of Canaan, *Deam 26278* (G). KENTUCKY: Jessamine Co., Wilmore, *F. T. McFarland, Fl. of Ky. 1st Cent. 79* (C-Cl, G, Mo, P, WV). Lincoln Co., 6–7 miles s. of Stanford, *E. T. Wherry & F. W. Pennell 13719* (P). Nelson Co., without locality, *Sister Rose Agnes*, Sept. 14, 1933 (C).

Warren Co., Bowling Green, *Sadie F. Price*, Sept. 26, 1902 (Mo). LOUISIANA: Natchitoches Parish, Chopin, *E. J. Palmer 8827* (Mo). Without locality (vicinity of Alexandria?), *Dr. Joseph Hale* (Mo, P). MARYLAND: Montgomery Co., near Glen Echo, *S. F. Blake 9736* (G, RM). Prince George Co., e. of Riverdale, *Agnes Chase 2548* (Ill). MISSISSIPPI: Panola Co., banks of the Tallahatchie, *H. Eggert*, Aug. 18, 1898 (Mo). NEW JERSEY: Camden Co., Bellmawr, *Bayard Long 13910* (G); Locust Grove, *Long 15145* (G); Woodcrest, *Long 17553* (G). Hunterdon Co., Milford, *K. K. Mackenzie 6348* (G), *H. L. Fisher*, Sept. 20, 1915 (Mo). Warren Co., below Phillipsburg, *T. C. Porter*, Sept. 5, 1893 (G). NORTH CAROLINA: Buncombe Co., Biltmore, *Biltmore Herb. 558* (C, mixed with a *Eupatorium*), *558b* (G, P). Modell Co., without locality, *M. E. Hyams* (D). OHIO: Franklin Co., Columbus, collector not named, Aug., 1840 (G). PENNSYLVANIA: Allegheny Co., Harrison Tp., *J. A. Shafer 1482* (G). Berks Co., 1 mile n.e. of Virginville, *Hans Wilkens 6423* (G); $1\frac{1}{4}$ mile s.w. of Rickenbach, *Wilkens*, Oct. 10, 1931 (G). Chester Co., Frazer, *E. B. Bartram 1111* (G). Dauphin Co., Harrisburg, *Isaac Bush*, Oct. 4, 1868 (P). Franklin Co., near Chambersburg, *Porter*, July 23, 1896 (P). Huntingdon Co., Hohn's Bridge, collector not named, Sept. 16, 1940 (G). Lancaster Co., Lancaster City, *Mrs. A. F. Ely*, Sept., 1884 (Mo); 3 miles n. of Lancaster, *J. K. Small*, Aug. 24, 1889 (Ill). Montour Co., Danville, *Dr. W. B. Meredith*, Aug. 18, 1900 (P). Northampton Co., Bethlehem, *J. Wolle* (G); Easton, *Herb. Traill Green*, Sept. 22, 1858 (G). SOUTH CAROLINA: Aiken Co., Aiken, *H. W. Ravenel*, Sept. 15, 1866 (Mo). Berkeley Co., Santee Canal, *Ravenel*, September (G). Oconee Co., Clemson College, *H. D. House 2914* (Mo). Pickens Co., near Clemson College, *House 3008* (Mo). Without locality, *Stephen Elliott* (P, probable isotype of *Kuhnia glutinosa* Ell.). TENNESSEE: Davidson Co., West Nashville, *W. W. Eggleston 5159* (Mo), *5167* (G, Mo, P; peculiar form with rather dense, white, lanose pubescence on the leaves). Hamilton Co., Lookout Mt., *J. D. Smith*, Sept. 5, 1893 (G). Knox Co., Knoxville, *Albert Ruth 45*, Aug. 10, 1890 (G). TEXAS: Bastrop Co., without locality (probably at Bastrop), *H. H. Duval*, Sept. 20, 1938 (T). Bexar Co., Kicaster, *Parks & Cory 27713–14* (TAM); 3 miles w. of Kicaster, *Parks 5405* (TAM). Brazos Co., near Brazos Bridge, *H. Ness*, July 16, 1899 (TAM); Brazos River bed, *Ness*, June 26, 1925 (TAM); 2–3 miles e. of Koppe Bridge, *R. G. Reeves*, Aug. 23, 1941 (TAM). Fayette Co., Colony, *Crawford*, in 1893 (Mo). Gonzales Co., Ottine, *Tharp*, Sept. 18, 1927 (T). Milam Co., 5 miles e. of Cameron, *Simon E. Wolff 3693* (TAM). Newton Co., 22 miles s. of Newton, *Parks & Cory 10956* (TAM). Polk Co., Indian Reservation, *E. B. Girvin*, Nov. 1, 1940 (T). Upshur Co., Glenwood, *Ruth 152*, Sept. 1, 1910 (T). Walker Co., n. of Huntsville, *Parks & Cory 10478* (TAM). Wilson Co., Kicaster, *Parks & Cory 11778* (TAM); Sutherland Springs, *Parks 15457* (TAM), *15458* (G). VIRGINIA: Bedford Co., without locality, *A. H. Curtiss*, Sept. 5, 1871 (G). Brunswick Co., s. of Edgerton, *M. L. Fernald & W. Lewis 14504* (G). Dinwiddie Co., s. of Carson, *Fernald & Long 7654* (G). Fauquier Co., $1\frac{3}{4}$ miles n. of Hopewell Gap, western slope of Bull Run Mts., *H. A. Allard 7315* (G). Frederick Co., Middletown, *F. Hunnewell 11345* (G). Hanover Co., n. of Gum Tree, *Fernald & Long 7653* (G). James City Co., w. of Williamsburg, *E. Jerome Grimes 4349* (G). Lee Co., vicinity of Pennington Gap, Powell River, *Lloyd G. Carr 1021* (G). Montgomery Co., 2 miles e. of East Radford, *J. W. Adams & E. T. Wherry 2274* (G). Prince George Co., n.w. of Talpa, *Fernald & Long 9635* (G). Rockbridge Co., 4 miles s. of Lexington,

J. R. Churchill, Aug. 23, 1924 (Mo); Natural Bridge, *Bartram*, Sept. 13, 1907 (P). Rockingham Co., Mt. Crawford, *A. Arthur Heller & E. Gertrude Halbach*, Aug. 7, 1893 (P). Shenandoah Co., near Strasburg, *Hunnewell 15750* (G); 11 miles from Woodstock, *Allard 5583* (G). Southampton Co., n. of Point Beach, s. of Franklin, *Fernald & Long 11453* (G, Mo). Sussex Co., 6 miles n.w. of Jarratt, *Fernald & Long 11454* (G). WEST VIRGINIA: Grant Co., Cabins, *Mr. & Mrs. H. A. Davis*, Aug. 22, 1939 (WV); near Williamsport, *Ward Sharp*, Aug. 26, 1930 (WV). Greenbrier Co., 2 miles w. of White Sulphur, *L. F. Randolph & Fannie R. Randolph 1247* (G). Hampshire Co., Hanging Rock, *Wilbert Frye 120* (WV). Hardy Co., Wardensville, *E. E. Berkley 1702* (Mo); same locality, *Core & Ludwig 4375* (WV). Mineral Co., near Burlington, *Berkley 1668* (Mo); Patterson Creek, *W. Va. Univ. Bot. Exp.*, Aug. 21, 1928 (WV). Wirt Co., about 1½ miles up Little Kanawha River from Palestine, *Elizabeth Ann Bartholomew, So. Appal. Bot. Club 3rd Distrib. no. 266* (WV).

6b. KUHNIA EUPATORIOIDES var. **ozarkana** Shinners, var. nov.

Var. *pyramidali* similis, foliis plerumque angustis, phyllariis exterioribus conspicue elongatis filiformi-attenuatis.

Resembling var. *pyramidalis* in vegetative parts, averaging slightly more pubescent throughout, the stem leaves usually rather narrow, oblong-lanceolate to linear-lanceolate, those near the middle of the stem or just below up to 8 cm. long, 1.5 cm. wide. Involucres 8.3–10.2 mm. high, with 10–14 florets; outer phyllaries with conspicuous, elongate, spreading or twisted, filiform tips, often nearly equalling the inner ones.

The type was collected on rocky slopes (dolomite) of "Bald Jesse," bald knobs near Gainesville, Ozark Co., Missouri, by E. J. Palmer, no. 33075, Oct. 10, 1927 (in Herb. Missouri Botanical Garden; isotype in Gray Herb.). The variety is confined to the Ozark region of Arkansas, Missouri, and southern Illinois. Occasional plants with more than 14 florets per head, and rather broad leaves, are probably to be considered hybrids between var. *ozarkana* and var. *corymbulosa*, though exactly simulating var. *texana* in technical characters.

Some additional specimens examined: ARKANSAS: Carroll Co., Eureka Springs, *E. J. Palmer 4414* (Mo). Pike Co., Boto, *Delzie Demaree 9394* (D, G). Pulaski Co., Pulaski Heights, Little Rock, *Demaree 8199* (D, G), *8225* (D). Washington Co., Fayetteville, *F. L. Harvey, Ark. Fl. no. 32* (P). ILLINOIS: Johnson Co., 4 miles s. of Vienna, *H. A. Gleason 2791* (G). MISSOURI: Franklin Co., Sullivan, *John H. Kellogg 15332* (Mo). Ozark Co., Tecumseh, *Edgar Anderson*, Nov., 1928 (Mo). Phelps Co., Jerome, *Kellogg, Mo. Pl. no. 2060* (Mo). St. Louis Co., Clayton, *G. H. M. Gehring 264* (Mo). Shannon Co., Birch Tree, *B. F. Bush*, Sept., 1888 (G); Monteer, *Bush 5103* (G).

6c. KUHNIA EURATORIOIDES var. **texana** Shinners, var. nov.

Var. *corymbulosae* similis habitu pubescentia capitulisque multifloris; var. *ozarkanae* similis phyllariis exterioribus conspicue elongatis filiformi-attenuatis.

Resembling var. *corymbulosa:* densely gray-pubescent throughout, the

leaves typically rather broad, rhombic or diamond-shaped, crenate to deeply and irregularly salient-dentate, prominently and almost rugosely reticulate-veined beneath, those of the main stem about 3–5 cm. long, 1–2 cm. wide. Inflorescence normally rather small and compact (but injured plants branching low down very common). Involucres 8.5–11.0 mm. high, with 17–33 florets; middle and outer phyllaries with conspicuous, elongate, falcate or twisted, filiform tips, often nearly equalling the inner.

The type was collected in blackland prairie, in thin clay soil over limestone, on Coit Road, 2½ miles north of University Park, Dallas, Dallas Co., Texas, by L. H. Shinners, no. 8475, Sept. 21, 1945 (in herb. Southern Methodist University). The variety is restricted to the blackland prairie and nearby limestone areas of central Texas and Oklahoma.

Some additional specimens examined: OKLAHOMA: Comanche Co., Ft. Sill, *Mrs. J. Clemens 11824* (G). Le Flore Co., near Page, *G. W. Stevens 2746* (G). Osage Co., near Myers, *Stevens 2064* (D, G, Ill, Mo). Pawnee Co., Pawnee, *J. W. Blankinship*, Aug. 29, 1895 (G). Payne Co., Stillwater, *Waugh 306* (Mo); 14 miles s.w. of Stillwater, *R. M. House*, Sept. 25, 1932 (T). TEXAS: Austin Co., San Felipe de Austin, *T. Drummond 159* (G). Baylor Co., 5¼ miles s. of Seymour, *Parks & Cory 15918* (TAM). Bell Co., Belton, *Whitehouse*, Aug. 23, 1929 (T); near Bland, *Wolff 2505* (TAM); 3 miles n. of Troy, *Wolff 1230* (TAM). Bexar Co., Comanche Spring, *Lindheimer, Fl. Tex. Exs. 934* (C, G, Mo). Blanco Co., Blanco, *E. J. Palmer 12884* (C). Burnet Co., 3.1 miles n. of Burnet, *Parks & Cory 15672, 15674* (TAM). Clay Co., 13 miles n.e. of Henrietta, *Cory 40760* (G). Collin Co., McKinney, *Tharp*, Sept. 25, 1927 (T; approaching var. *corymbulosa*). Comal Co., near New Braunfels, *Lindheimer field no. 521 (Fl. Tex. Exs. 410)* (C, G, Mo, P). Dallas Co., Dallas, *Bush 1152* (Mo), *Julien Reverchon 3299* (Mo). Gillespie or Kerr Co., Fredericksburg-Kerrville, *Whitehouse*, Sept. 1 and Sept. 2, 1930 (T). Hunt Co., near Floyd, *Wolff 3327* (TAM). Kerr Co., 4.3 miles n. of Center Point, *Cory 20702* (G). Lipscomb Co., without locality, *Parks & Cory 16240* (TAM). Palo Pinto Co., Brazos, *Ellen Wadsworth*, Sept., 1930 (T). Parker Co., Weatherford, *Tracy 8145* (G, T; approaching var. *corymbulosa*). Rockwall Co., without locality, *H. Ness*, Oct. 5, 1923 (TAM). Tarrant Co., Ft. Worth, *A. Ruth 19*, Oct. 17, 1910 (T); Handley, *Ruth 79*, Oct. 1, 1912 (G, Mo; same number and date but without locality, Ill; same number, dated Oct. 1, 1919, without locality, P); without locality, *Ruth 179*, June 2, 1929 (SMU). Taylor Co., near Abilene, *W. L. Tolstead 7733* (C-Cl). Travis Co., Austin, *Tharp*, Nov. 4, 1932 (Mo, T). Washington Co., without locality, *Eunice Brackett*, Oct. 1938., (T). Wheeler Co., Heald, collector not named, Oct. 7, 1908 (T). Wilson Co., Sutherland Springs, *Dr. Edward Palmer 444* in 1879 (Mo).

The following specimens show technical characters of var. *texana*, but from the localities in which found are probably rather to be considered hybrids between var. *ozarkana* and var. *corymbulosa*. The Texarkana collection possibly represents a railroad introduction.

ARKANSAS: Miller Co., on Iron Mt. R. R., Texarkana, *G. W. Letterman 5* (Mo). MISSOURI: Adair Co., Kirksville, *C. S. Sheldon 3462b* (C, with 15 florets; C-Cl, with 17 florets); same locality, without number, Aug. 28.

1885 (D, with 16 florets). Greene Co., without locality, *Bush 190* (Mo, with 15 florets).

6d. KUHNIA EUPATORIOIDES var. CORYMBULOSA T. & G., Fl. N. A. 2: 78. 1841. (At first described merely as a habit form, without distinctive range; more precisely defined as the western race of the species by A. Gray, Syn. Fl. N. A. 1, pt. 2: 103. 1884.)

K. suaveolens Fresenius, Semina in horto botanico Francofurtensi anno 1838 collecta. (Reviewed and descriptions of new species published in Linnaea 13, Lit. p. 94. 1839.)
K. Maximiliani Sinning, Allgem. Gartenzeit. 7 (=18): 137–138. May 4, 1839.
K. macrantha Buckley, Proc. Acad. Nat. Sci. Phila. 13 (1861): 456. 1861. (The type sheet also contains some fragments belonging to var. *texana*. The description, of a purple-flowered plant blooming in spring, could not possibly have been drawn from a *Kuhnia*.)
K. Fitzpatricki A. Nelson, Bot. Gaz. 31: 402. 1901.
K. Gooddingi A. Nelson, Bot. Gaz. 31: 402–403. 1901. (Form with rather narrow, nearly entire leaves and loose inflorescence, slightly approaching *K. chlorolepis*.)
K. Hitchcocki A. Nelson, Bot. Gaz. 31: 403. 1901.
K. reticulata A. Nelson, Bot. Gaz. 31: 403–404. 1901.
K. jacobaea Lunell, Amer. Midl. Nat. 5: 36. 1917.

The names *Kuhnia glutinosa* Ell., and *K. eupatorioides* var. *glutinosa* (Ell.) Hitchc. have been used for this variety, but they properly are synonyms of *K. eupatorioides* var. *pyramidalis* Raf.

Plants coarser and stouter, though usually shorter, than in var. *pyramidalis*; stems commonly 30–60, occasionally as much as 115 cm. tall, densely and finely pubescent, single (infrequently) to several or many from one root, erect to widely spreading or even decumbent. Leaves rather firm, thicker and stiffer than in var. *pyramidalis*, and more prominently, almost rugosely, veined; scabrous above, from pubescent on the veins to densely pubescent over the whole surface beneath, often very abundantly resin-dotted; rarely entire, usually even the uppermost dentate or laciniate-toothed, divided as much as half way to the midrib; subsessile or on very short petioles. Inflorescence sometimes only a small, dense, terminal corymb, or at the other extreme, the whole plant bushy-branched from the base, bearing heads throughout. Heads usually in compact clusters of 3–8 or more, on peduncles 3–12(–20) mm. long. Involucres 8.7–14.0 mm. high, with 14–33 florets. Phyllaries moderately to densely hirsutulous and resin-dotted, the middle and inner oblong or linear, 1.0–1.8 mm. wide. Achenes usually 10-ribbed, but sometimes appearing 15- or 20-ribbed, probably as a result of drying.

In the High Plains, drought, grasshoppers, and grazing animals sometimes work bewildering changes in the appearance of the plant. Stem leaves may be entirely wanting at flowering time, the inflorescence variously deformed, and flowering advanced or retarded. In the southern plains especially, normal plants comparable to those found farther east

are hardly ever to be found. A number of fragmentary collections from southeastern Colorado, the Texas Panhandle, and adjacent New Mexico, without stem leaves and with loose inflorescences, were at first hesitantly assigned to *Kuhnia chlorolepis*, as a peculiar plains form. Later and better material shows that most are simply growth forms of *K. eupatorioides* var. *corymbulosa;* a few are possibly to be regarded as intermediates between these two.

In the Middle West, with usually more moisture available than in the High Plains, plants injured early in the year may send up late-flowering leafy shoots, atavistically resembling var. *pyramidalis*. The leaves are thinner, less pubescent, more entire, and persist through flowering; the involucres are smaller and with fewer florets. Fragments from such plants are hardly to be separated from var. *pyramidalis*, unless on the basis of geography.

A few midwestern specimens, particularly some from Nebraska and Wisconsin, have very large involucres with slenderly pointed outer phyllaries, slightly resembling those of var. *texana;* but there is probably no real relationship between them.

The type, a specimen collected in Illinois by S. B. Buckley, without indication of precise locality or date, has been selected from among those in the Gray Herbarium bearing both the official T. & G. Flora of North America label, and that of Gray's Synoptical Flora. The variety is common throughout the prairie and plains region, from western Ohio to extreme northeastern New Mexico and Montana.

Some specimens examined: COLORADO: Boulder Co., foot of Flagstaff Mt., Boulder, *J. Ewan & N. Ewan, Plantae Exsiccatae Grayanae 878* (C, D, G, Ill, Mo, P, RM, SMU, WV). El Paso Co., Cascade, *Clokey 3312* (RM). Jefferson Co., Arvada, *Clokey 3878* (C, D, Ill, P). Larimer Co., Dry Creek, *Goodding 581* (C, G, RM), *8202* (G, isotype of *Kuhnia Gooddingii* A. Nelson). Pueblo Co., Pueblo, *R. W. Woodward* in 1882 (G). Weld Co., Windsor, *Osterhout 4647* (RM). ILLINOIS: Champaign Co., near Urbana, *G. N. Jones 16274* (Ill). Clinton Co., Carlyle, *Buckley*, Sept., 1858 (P). Dupage Co., Naperville, *L. M. Umbach*, Sept. 7, 1894 (Ill). Hancock Co., Augusta, *S. B. Mead*, in 1844 (G; apparently the same, without date, P); Hamilton, *F. C. Gates 10808* (Ill, Mo). Henderson Co., n. of Oquawka, *D. E. Eyles & M. S. Eyles 362* (G). Kane Co., Elgin, *E. E. Sherff 1982* (Ill, Mo). Kankakee Co., near Altorf, *E. J. Hill*, Aug. 30, 1872 (Ill). Macon Co., Decatur, *R. Mills & L. Knight*, Sept. 9, 1903 (C-Cl). Mason Co., Havana, *Gleason*, Aug. 15, 1903 (G). McLean Co., *Hill*, Aug. 15, 1870 (Ill). Ogle Co., Oregon, *W. S. Moffatt 302*, Aug. 25, 1894 (Ill). Peoria Co., Peoria, *F. E. McDonald*, Aug., 1900 (RM), Aug., 1903 (G). Stark Co., Wady Petra, *V. H. Chase 786* (RM). Whiteside Co., Prophetstown, *Moffatt 538*, Sept. 15, 1896 (Ill). Will Co., near Joliet, *J. M. Greenman 2674* (G). INDIANA: Benton Co., without locality, *E. F. Shipman*, Aug. 25, 1876 (P). Elkhart Co., ½ mile e. of Bristol, *Deam 26346* (G). Knox Co., 4 miles s. of Vincennes, *Deam 24117* (G). Lagrange Co., 3 miles n.e. of Howe, *Deam 14940* (G). Lake Co., Forsythe, *Hill*, Sept. 18, 1880 (Ill); Miller, *J. R. Heddle 130* (SMU). Porter Co., Dune Park, *Agnes Chase 470* (Ill); same locality, *Umbach 1446* (C). Vigo Co., 5 miles n. of Terre

Haute, *Deam 23974* (G). IOWA: Allamakee Co., Hanover Tp., sec. 9, *Tolstead*, Aug. 9, 1933 (C-Cl, Mo). Black Hawk Co., Waterloo, *Myrel Burk 926* (Ill). Dallas Co., Redfield, *J. A. Allen*, Sept. 10, 1867 (G). Decatur Co., Lamoni, *H. P. Anderson*, Aug., 1895 (RM), Aug., 1905 (G). Dickinson Co., near Big Kettle Hole, *W. B. Fox 83* (WV). Emmet Co., 6 miles s. of Estherville, *Ada Hayden 10597* (P). Fayette Co., Fayette, *B. Fink*, Aug., 1894 (G). Greene Co., New Jefferson, *Allen*, Aug. 26, 1867 (G). Hardin Co., Iowa Falls, *Morton E. Peck*, Aug., 1928 (G). Linn Co., near Cedar Rapids, *A. A. Heller 14301* (D, P). Poweshiek Co., Grinnell, *M. E. Jones* (RM). Story Co., Ames, *L. H. Pammel, Pl. of Iowa 209* (G, Mo, RM). KANSAS: Cheyenne Co., s. of Wheeler, *Gates 16797* (RM). Ellis Co., 2 miles w. of Hays, *Earl Bondy 315* (RM). Geary Co., s. of Junction City, *Gates 19791* (G). Greeley Co., Tribune, *Minnie Reed*, Sept. 3, 1892 (RM). Meade Co., without locality, *A. S. Hitchcock, Pl. of Kansas 211a* (G; isotype of *Kuhnia Hitchcocki* A. Nelson). Phillips Co., Long Island, *J. B. Hatcher*, Sept. 4, 1883 (C). Rawlins Co., Atwood, *Agrelius & Wilson 261* (RM). Riley Co., Manhattan, *Reed*, Aug. 31 and Sept. 26, 1891 (C); without locality, *J. B. Norton 211* (G, Mo, RM). Sedgwick Co., Wichita, *M. A. Carleton*, Sept. 17, 1888 (Ill). MINNESOTA: Hennepin Co., near Minneapolis, *Geo. B. Aiton*, Aug., 1891 (C-Cl); without locality, *Aiton 913* (Ill), *F. H. Burglehaus*, Aug., 19, 1891 (RM). Lincoln Co., Lake Benton, *E. P. Sheldon*, Aug., 1891 (C, D, G, P, RM). Nobles Co., Adrian, *Herb. Jane B. Patten*, Aug. 20, 1895 (G). Winona Co., without locality, *J. M. Holzinger*, Sept., 1901 (P). MISSOURI: Boone Co., Columbia, *Francis Drouet 1051* (G). Clark Co., 1½ miles n.e. of Wayland, *Drouet 1721* (G). Jackson Co., Buckner, *J. H. Kellogg 15331* (C-Cl); Lee's Summit, *Bush 7E* (G), *Mackenzie 411* (RM). Jasper Co., Webb City, *E. J. Palmer 1035* (Mo). St. Louis, *Drummond* (G); *H. Eggert*, Sept. 3, 1886 (C,RM). MONTANA: Cascade Co., Great Falls, *F. W. Anderson 189* (C). Gallatin Co., Bozeman, *Blankinship, Pl. of Montana 280* (C, D, P, RM). Hill Co., Box Elder, *Blankinship*, July 14, 1900 (RM). Lewis & Clark Co., Helena, *E. N. Brandegee* (C); Kirkendall, near Helena, *F. D. Kelsey*, Aug. 9, 1890 (C, D, Ill). NEBRASKA: Brown Co., Long Pine, *J. M. Bates*, Aug. 14, 1900 (G). Cass Co., 2 miles n.e. of Louisville, *John L. Morrison 1356* (D, Mo). Cherry Co., 10 miles s. of Cody, *Tolstead 489* (G). Cheyenne Co., Sidney, *A. Nelson 9277a* (C, RM). Dawson Co., near Gothenburg, *Heller 14301* (D). Douglas Co., Omaha, *Lillian Eastman*, Sept. 10, 1915 (Ill). Grant Co., 3 miles n.e. of Whitman, *P. A. Rydberg 1636* (G). Kearney Co., Minden, *H. Hapeman*, various dates (C, C-Cl, D, G, P, RM, WV). Lancaster Co., near Lincoln, *E. H. Seal* (P). Lincoln Co., near North Platte, *C. L. Shear*, Sept. 7, 1895 (RM). Washington Co., near Arlington, *Anna L. Lallman*, Sept. 7, 1930 (RM). Webster Co., Pawnee Recreation Grounds, *Tolstead*, Aug. 9, 1933 (C-Cl). NEW MEXICO: Curry Co., Clovis, *Whitehouse*, Sept. 3, 1929 (T). Quay Co., Nara Visa, *Geo. L. Fisher 48*, Sept. 19, 1910 (G; apparently the same collection, without number, Ill, RM). NORTH DAKOTA: Barnes Co., Valley City, *C. Westergaard*, July, 1898 (RM). Burleigh Co., Bismarck, *J. Lunell 393* (Ill). Ransom Co., Anselm, *O. A. Stevens 219* (C, RM). Ward Co., Minot, *Lunell*, Sept. 10, 1902 (D, G, Ill, P, RM). OHIO: Erie Co., Margaretta, *E. L. Moseley*, Aug. 22, 1895 (G). OKLAHOMA: Comanche Co., Camp Boulder, Wichita National Forest, *C. T. Esker 1479* (G). Creek Co., Sapulpa, *Bush 214, 1352* (Mo); near Sapulpa, *Charles B. Williams 6* (P). Kingfisher Co., 3 miles w. of Kingfisher, *O. E. Stout 34* (RM). Payne Co., 2½ miles n. & 2 miles w. of Stillwater, *Edward*

Conrey 86 (C-Cl). Woods Co., near Alva, *Stevens 2879* (D, G, Ill). SOUTH DAKOTA: Corson Co., 5 miles e. of Morristown, *J. F. Brenckle & L. H. Shinners*, Aug. 3, 1941 (RM). Harding Co., Table Mt. Caves, *S. S. Visher 361* (RM). Hughes Co., Pierre, collector not named, Aug. 27, 1896 (RM). Kingsbury Co., Iroquois, *J. J. Thornber*, Aug. 7, 1894 (C, G, Mo). Meade Co., Faith, *L. R. Moyer 144* (RM). Moody Co., 2 miles e. of Colman, *Philip Johnson 56* (G, Ill). Pennington Co., Rapid City, *A. C. McIntosh 584* (RM). Perkins Co., Bixby, *Visher 636* (RM). Spink Co., vicinity of Redfield, *Alfred E. Ricksecker 58* (C, Ill). TEXAS: Bexar Co., "Bejar" (San Antonio), *Louis Berlandier 1804* (G; probably this). Briscoe Co., $13\frac{1}{2}$ miles n.e. of Silverton, *Parks & Cory*, Sept. 26, 1935 (TAM). Childress Co., without locality, *High School Biology Class* (T). Hartley Co., 5.4 miles s.w. of Middlewater, *Parks & Cory 16332 33* (TAM). Lubbock Co., Lubbock, *E. L. Reed*, Sept. 19, 1934 (T). Mitchell Co., Colorado, *Tracy 8156* (G, T). Potter Co., s.w. of Bushland, *Parks & Cory 16494–97* (TAM). Randall Co., Palo Duro Canyon, *M. S. Young*, Sept. 9, 1917 (C-Cl, T). Sherman Co., 3 miles s.w. of Stratford, *Parks & Cory 16331* (TAM). Sutton Co., Sonora, *Cory*, Oct. 26, 1925 (TAM; doubtfully this). Throckmorton Co., Spring Creek, *Parks & Cory 7465* (TAM). Wheeler Co., 4.7 miles s.e. of Shamrocks, *Parks & Cory 16153* (TAM; same, as *Cory 16154*, G). WISCONSIN: Dane Co., Madison, *Shinners 4130* (C-Cl, G, RM). Grant Co., Rutledge, *Milwaukee Museum Expedition*, Aug. 8, 1911 (SMU). La Crosse Co., Onalaska, *N. C. Fassett 4473* (G). Polk Co., St. Croix Falls, *Sheldon*, Sept., 1891 (G, Ill, RM). WYOMING: Albany Co., Laramie, *A. Nelson*, Sept., 1893 (RM). Big Horn Co., Spring Creek, *Goodding 347* (C, D, G, RM). Crook Co., 3 miles n.w. of Hulett, *Ownbey 474* (RM); Sundance, *A. Nelson 9522* (D, G, RM).

The following specimens have few florets, thin leaves, or other characteristics of var. *pyramidalis*, but from the localities in which found should be var. *corymbulosa*, and are probably injured growth forms of the latter, which often resemble var. *pyramidalis:*

ILLINOIS: Champaign Co., Champaign, *Clokey 143* (C-Cl; with 11 florets). INDIANA: Tippecanoe Co., s.w. of Lafayette, *Charles M. Ek*, Sept. 30, 1942 (Mo).

7. KUHNIA ADENOLEPIS Robinson, Proc. Amer. Acad. 47 (also Contr. Gray Herb. 39): 201. 1911.

Stems 60–90 cm. tall, striate, glabrous below, minutely pubescent above, simple to the inflorescence which occupies the terminal eighth to fourth of the plant. Stem leaves rather few, subsessile or sessile, or the upper very slightly clasping, lanceolate, 3-nerved at the rather broad base, slightly coriaceous, dark green and finely roughened above, paler, glabrous, and punctate beneath, entire or with few prominent sharp teeth, the largest up to 7 cm. long and 16 mm. wide, the upper much reduced. Heads solitary or few, terminal on the relatively few, ascending, nearly naked branches, erect or slightly nodding before maturity. Involucres about 10–15 mm. high, with 10–18 florets. Middle and inner phyllaries linear or oblong, abruptly acute and with a prominent mucronate or spiny tip up to 1.5 mm. long, strongly striate, glabrous, with rather prominent white-scarious,

glabrous or more or less glandular-ciliate margins; outer phyllaries oblong-oval, pubescent and glandular-ciliate, about 1.3–1.5 mm. wide. Corollas about 8 mm. long, dark yellow to dark red. Achenes (fully mature ones not seen) about 5 mm. long, densely pubescent with subappressed hairs. Pappus bristles about 7 mm. long, stramineous or light brown, less strongly plumose than in most species of the genus.

The type was collected in the Chapala Mountains near Guadalajara, Jalisco, Mexico, by C. G. Pringle, no. 2933, Dec. 13, 1889 (in Gray Herb.). Known only from the following additional collection:

JALISCO: San Sebastian, Sierra Madre Occidental, south slope of open pine forest, *Ynes Mexia 1665*, Feb. 13, 1927 (C, D, G, Mo).

EXCLUDED SPECIES

Kuhnia arabica Hochst. & Steud. ex DC., Prodr. 7: 267. 1838. = *Pegolettia senegalensis* Cass., according to Index Kewensis.

Kuhnia arguta H. B. K., Nov. Gen. et Sp. Pl. 4: 105. 1820. I am not at present able to identify this plant, but it is not a *Kuhnia*. Found in Colombia, it was said to be a foot high, with alternate, narrowly lanceolate, evenly sharp-toothed leaves, flower heads 3½ lines (about 7 mm.) long, phyllaries about 12, oblong-spatulate, rather obtuse and subequal, rosy florets twice as long as the involucre, with slender tube, campanulate limb, and lobes ciliate with jointed hairs, free anthers, and 5-angled achenes 1½ lines (about 3 mm.) long with plumose pappus. The genus *Kuhnia* is not known to occur south of Mexico; in none of the species are the leaves evenly sharp-toothed (though this is approached in *K. adenolepis*), the phyllaries subequal, the corollas divided into distinct tube and limb, the corolla lobes ciliate, or the achenes only 5-angled. The involucre and achenes are both much smaller than are to be expected in *Kuhnia*. Free anthers are to be found in a number of genera other than *Kuhnia*, and plumose pappus, though a prominent characteristic of the genus, is not confined to it.

Kuhnia baccharoides DC., Prodr. 5: 127. 1836. = *Symphyopappus viscosus* Sch. Bip. ex Baker, according to Index Kewensis.

Kuhnia frutescens Hornemann, Hortus regius botanicus hafniensis in usum tyronum et botanophilorum 2: 791. 1815. The whole original description was "caule fruticoso, foliis linearibus obtusis margine revolutis, corymbo terminali, pedunculis aphyllis pubescentibus," followed by the symbol for a shrub. Habitat unknown, "intr. 1813. ex hort. paris. sub hoc nomine." Said to be allied to *K. rosmarinifolia*. Not identifiable, even as to genus or tribe.

Kuhnia fruticosa Ventenat ex Steudel, Nomencl. Bot. ed. 1, p. 322. 1821. The mere name, listed in synonymy; probably an error for the preceding, or more likely an unpublished name of Ventenat's transmogrified into *K. frutescens* by Hornemann.

Kuhnia glabrata DC., Prodr. 5: 127 1836. = *Eupatorium oblongifolium* Baker, according to Index Kewensis.

Kuhnia hirtiflora DC., Prodr. 5: 127. 1836. = *Trichogonia hirtiflora* (DC.) Sch. Bip. ex Gardner, according to Index Kewensis.

Kuhnia icosantha Sch. Bip., Linnaea 22: 572. 1849. = *Trichogonia podocarpa* (DC.) Sch. Bip., according to Index Kewensis.

Kuhnia linearifolia Spreng., Syst. Pl. 3: 439. 1826. = *Jaumea linearis* Pers., according to Index Kewensis.

Kuhnia multiramea Turcz., Bull. Soc. Nat. Mosc. 24, 1: 168. 1868. = *Ophryosporus triangularis* Meyen, according to Index Kewensis.

Kuhnia pinnata J. F. Gmel., Syst. Nat. ed. 13, p. 375. 1789. = *Petalostemum corymbosum* Michx., according to Index Kewensis.

Kuhnia podocarpa DC., Prodr. 5: 127. 1836. = *Trichogonia podocarpa* (DC.) Sch. Bip., according to Index Kewensis.

Kuhnia pyrifolia Martius, Plantarum Horti Academici Erlangensis enumeratio, p. 175. 1814. Based on a cultivated plant without flowers or fruit, said to resemble *K. rosmarinifolia* Vent. Completely unidentifiable.

Kuhnia rosmarinifolia Ventenat, Description des plantes nouvelles et peu connues cultivées dans le jardin de J. M. Cels. Pt. 10, *Pl. 91.* 1801 or 1802 ("An IX" of the calendar of the French revolution, Sept. 22, 1801 to Sept. 22, 1802). This was ostensibly a new name for *Eupatorium canescens* Ortega, described in Novarum aut rariorum plantarum Horti Regii Botanici Matritensis descriptionum decades, p. 34, 1797, that name being cited as synonym. Ortega's description was drawn from a garden plant raised from seed sent by Sesse, said to have come from Cuba. The diagnostic phrase given was "E. foliis linearibus sessilibus: inferioribus denticulatis." In the amplified description, the stem was said to be erect, angled, branched, paniculate; the lower leaves opposite, lanceolate-linear, denticulate, 3-nerved, short-petiolate, the others few, spreading-reflexed, sessile, linear, entire; peduncles axillary and terminal, one-flowered, erect; phyllaries linear-subulate, striate; corollas about 30, tubular, yellowish; seeds linear, striate, greenish; other points "ut in charactere generico Linnaeano." *Eupatorium canescens* Ortega, not Vahl, was listed as a synonym of *Eupatorium cubense* Persoon by Steudel, Nomencl. Bot. ed. 1, p. 322, 1821.

The plant grown in the garden of Cels, from seeds sent by Ortega, and upon which Ventenat's description was based, was not the same as Ortega's. The leading diagnostic phrase was altered to "Kuhnia foliis lineari-lanceolatis, integerrimis, margine revolutis; pedunculis terminalibus, unifloris." The stems were said to be bunched, hard and almost woody, erect, leafy, much branched, the lower part cylindric and with cracked grayish bark, the upper faintly angled, pubescent, and ashy brown; leaves alternate, crowded, horizontal, sessile, linear and lanceiform, acute, 4 cm. long, 5 mm. broad, the upper slightly shorter; peduncles terminal on the branches

and branchlets, 1-flowered, bearing clasping bracts; flowers dark purple, (heads) 2 cm. long, 12 mm. broad; phyllaries lanceolate, acute, striate, imbricated, the outer (shown as rather obtuse in the plate) 6 mm. long, the inner "deux fois plus grands"; florets many; seeds enclosed by the persistent involucre "qui fait les fonctions de pericarpe," oblong, deep brown. The name given this cultivated plant of questionable antecedents and confused identity was adopted by Asa Gray for *Kuhnia chlorolepis*, with these observations (in the Synoptical Flora, 1, pt. 2, p. 103): "Hort. Cels. t. 91 (poor figure of a broadish-leaved form, with too much imbricated involucre): DC. 1. c. [Prodr. 5: 126] (excl. syn. Ort.?), but surely from Mexico, not 'Cuba'."

Evidently some mix-up occurred in the transmission of seeds from Madrid to Cels's garden, or in the labelling of the plants. It is fairly certain not only that Ortega and Ventenat described different plants, but that neither described a species of *Kuhnia*. Gray's action in taking up Ventenat's name is puzzling, for not only does the figure fail to match the species to which he applied it, but the description fits even less well.

Kuhnia Schaffneri A. Gray, Proc. Amer. Acad. 17: 207. 1882. As already noted under *K. microphylla*, the type includes abnormal plants of that species mixed with fragments of the underground parts of some unknown plant resembling a *Psoralea* or *Hoffmannseggia*, and the latter were emphasized in the description as an important characteristic of the species. Since it was based on a mixture, the name is discarded.

Kuhnia spicata (L.) Baillon, Histoire des Plantes 8: 298. 1881 or 1882. = *Liatris spicata* (L.) Willd., according to Index Kewensis, but very likely Baillon misapplied the name to some other species having plumose pappus; that of *L. spicata* is merely scabrous or barbellate.

Kuhnia villosa Spreng., Syst. 3: 439. 1826. = *Trichogonia villosa* (Spreng.) Sch. Bip. ex Gardner, according to Index Kewensis.

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PLANTS OF MEXICO AND CENTRAL AMERICA—I[1]

CYRUS LONGWORTH LUNDELL

The recently published study of the LAURACEAE of Mexico and Central America by Allen[2] is a welcome preliminary survey. Except for the acceptance of *Licaria* Aubl., revived by Kostermans[3] to replace *Acrodiclidium* Nees, the treatment is conventional. To accept *Licaria*, a genus which remained unrecognized for more than 150 years, is without justification in spite of Kostermans' (*l. c.*) assertion that he is certain of its identity. For *Licaria* was described from sterile material!

The well known *Misanteca* Schlecht. & Cham. (1831), which has priority over *Acrodiclidium* Nees (1833) merits recognition, for there is no question as to the identity of the type species, *Misanteca capitata* Schlecht. & Cham. Hence the species which have been referred to *Licaria* and *Acrodiclidium* are transferred to *Misanteca*.

Among the other LAURACEAE of Mexico and Central America, the status of various species which can be referred with equal justification to either *Persea* Miller, *Phoebe* Nees, *Ocotea* Aubl. or *Nectandra* Rolander remains unsolved. Unless these genera can be clearly delimited to indicate natural affinities, their reduction is inevitable. The size and shape of the staminodia and the degree of overlapping of the cells of the anthers, now considered primary generic distinctions, are too intangible to be uniformly interpreted.

A broad study to redefine generic limits in the LAURACEAE is an urgent need.

From the identification of recently accumulated collections of LAURACEAE, new species are described in the genera *Endlicheria*, *Nectandra*, *Persea* and *Phoebe*. The *Endlicheria* from Mexico is the first species of the genus to be reported north of Panama. In other families, new species are proposed in the genera *Lonchocarpus*, *Celastrus*, *Maytenus*, *Microtropis*, and *Parathesis*.

The illustration of *Microtropis stipitata* Lundell (fig. 3), one of a series drawn by Eduardo Salgado, was made possible through funds granted by the Horace H. Rackham School of Graduate Studies of the University of Michigan from the income of its endowment.

Endlicheria zapoteoides Lundell, sp. nov.—Arbor. 10 m. alta, ramulis novellis minute cano-sericeis. Folia opposita, subopposita vel alternata, petiolata, petiolo ad 1.5 cm. longo; lamina chartacea, lanceolato-elliptica

[1] The types are in the Lundell Herbarium.

[2] Journ. Arn. Arb. 26: 280–434. 1945.

[3] Meded. Bot. Mus. Utrecht. 42: 575–604. 1937 (Rec. Trav. Bot. Neerl. 34: 575–604. 1937).

vel elliptica, 5–16 cm. longa, 3–6.7 cm. lata, apice obtusa, basi rotundata, glabra, reticulata, nervis 10–13-paribus. Inflorescentia axillaris vel subterminalis, ad 8 cm. longa, parce puberula. Flores dioeci, ♀ ca. 3 mm. longi, lobis late ovatis, 1.5–1.8 mm. longis. Stamina 1–1.2 mm. longa, staminodia parva. Ovarium glabrum. Fructus subglobosus, ad 6 cm. longus, 5.5 cm. latus.

Tree, 10 m. high; buds and tips of twigs minutely cano-sericeous; branches reddish-brown, glabrous, rather stout. Leaves opposite, subopposite or alternate, petiolate, the petioles subterete, up to 1.5 cm. long, glabrous early, reddish-brown. Leaf blades chartaceous, the veins reddish-brown, lanceolate-elliptic or elliptic, 5–16 cm. long, 3–6.7 cm. wide, apex obtuse, base rounded and sometimes slightly decurrent, the sides equal or subequal, glabrous except for scattered appressed hairs along the costa, conspicuously reticulate-veined on both surfaces, the veins elevated, primary veins 10–13 on each side, arcuately ascending at a wide angle. Inflorescence axillary or subterminal, paniculate, branched almost to the base, up to 8 cm. long, sparsely pubescent with short subappressed hairs. Pistillate flowers appressed-puberulent or essentially glabrous, borne on short pedicels 1–3 mm. long, the tube about 1 mm. long, the lobes depressed-ovate, 1.5–1.8 mm. long, erect at anthesis, closely surrounding the exposed stigma. Stamens substerile or sterile; the two outer series 1 mm. long including short filaments, the anthers ovate, with protruding connective at apex; the third series about 1.2 mm. long, with two large glands at base of each filament, the anthers laterally dehiscent, or incompletely developed and subulate; the staminodia about 0.4 mm. long, sessile. Ovary glabrous, subglobose, equaling the conical style; stigma minute. Fruits large, subglobose, up to 6 cm. long, 5.5 cm. wide, the surface brownish, in appearance suggesting the fruits of the *zapote* and *sapodilla*; fruiting pedicels and supporting branches of the infructescence enlarged, up to 8 mm. in diameter; the cupule enlarged, the margin obscurely annular, fused with the fruit and pedicel.

MEXICO: Chiapas, Cascada near Siltepec, in advanced forest, alt. 1600 m., March 1, 1945, *Eizi Matuda 5153* (type), tree, 10 m. high.

This is the first species of the genus discovered north of Panama. From description it appears to have close affinity to the imperfectly known *E. Browniana* Mez.

The fruits are strikingly similar in outward appearance to those of the *zapote*, unlike any others in the family known to the writer.

Misanteca caudata (Lundell) Lundell, comb. nov. *Chanekia caudata* Lundell, Phytologia 1: 178. 1937.

Misanteca Cervantesii (H.B.K.) Lundell, comb. nov. *Laurus Cervantesii* H.B.K., Nov. Gen. & Sp. 2: 134. 1817.

Misanteca coriacea (Lundell) Lundell, comb. nov. *Chanekia coriacea* Lundell, Phytologia 1: 179. 1937.

Misanteca Cufodontisii (Kostermans) Lundell, comb. nov. *Licaria*

Cufodontisii Kostermans, Meded. Bot. Mus. Utrecht 42: 591. 1937 (Rec. Trav. Bot. Neerl. 34: 591. 1937).

Misanteca excelsa (Kostermans) Lundell, comb. nov. *Licaria excelsa* Kostermans, Meded. Bot. Mus. Utrecht 42: 595. 1937 (Rec. Trav. Bot. Neerl. 34: 595. 1937).

Misanteca glaberrima (Lundell) Lundell, comb. nov. *Acrodiclidium glaberrimum* Lundell, Lloydia 4: 46. 1941.

Misanteca lucida (Lundell) Lundell, comb. nov. *Acrodiclidium lucidum* Lundell, Contr. Univ. Mich. Herb. 7: 12. 1942.

Misanteca mexicana (Brandegee) Lundell, comb. nov. *Acrodiclidium mexicanum* Brandegee, Univ. Calif. Publ. Bot. 6: 497. 1919.

Misanteca misantlae (Brandegee) Lundell, comb. nov. *Acrodiclidium misantlae* Brandegee, Univ. Calif. Publ. Bot. 6: 497. 1919.

Nectandra albiflora Lundell, sp. nov.—Arbor parva, ad 25 cm. diam.; ramulis angulatis, novellis minute et dense adpresse cano- vel subferrugineo-pubescentibus. Folia alternata, petiolata, petiolo crasso, 0.6–1.3 cm. longo; lamina subcoriacea, pallida, oblongo-elliptica, oblanceolata vel lanceolato-oblonga, 11–35 cm. longa, 3–11.5 cm. lata, apice obtuse acuminata, basi acuta, raro rotundata, nervis 6–8-paribus, subtus elevatis. Inflorescentia axillaris, paniculata, ad 11.5 cm. longa, puberula. Pedicelli 2–3 mm. longi. Flores sericeo-pubescentes, lobis 4–4.5 mm. longis. Antherae parvae, papillosae, acutae. Fructus ellipsoideus vel subglobosus, 8–10 mm. diam. Cupula crassa, 3 mm. alta, integra. Pedicelli fructiferi ad 1.2 cm. longi.

Tree, up to 25 cm. in diameter; buds and apex of twigs canescent- or fulvous-pubescent with minute closely appressed hairs; branches stout, angled, reddish-brown, puberulent with subferruginous appressed hairs. Leaves with stout subcanaliculate petioles 0.6–1.3 cm. long, the petioles appressed-puberulent. Leaf blades subcoriaceous, pallid, oblong-elliptic, oblanceolate or lanceolate-oblong, 11–35 cm. long, 3–11.5 cm. wide, apex obtusely acuminate, base acute and decurrent to rounded, not or scarcely recurved, appressed puberulent at first on both surfaces, primary veins 6–8 on each side, strongly ascending, conspicuous and plane on upper surface, prominent on undersurface, reticulation obscure, occasionally bearing pubescent glands in the axils of the lateral nerves. Inflorescence paniculate, axillary, up to 11.5 cm. long, including peduncle up to 6.5 cm. long, few-flowered, puberulent with subappressed subferruginous hairs. Pedicels 2–3 mm. long. Flowers white, fragrant, minutely sericeous, the hairs canescent to subferruginous, with reflexed fleshy lobes, the lobes papillose within, elliptic or obovate, 4–4.5 mm. long, equal or subequal. Stamens of the two outer series unequal, the smaller about 0.7 mm. long, the longer up to 1.2 mm. long, the anthers subsessile, depressed-ovate, the fleshy papillose connective above cells triangular, acutish. Stamens of inner series 1.25–1.4 mm. long, the broad anthers slightly narrowed into thick filaments about 0.5 mm. long, the basal glands large and sessile, the

apex of anther papillose, acutish. Staminodia small, about 0.5 mm. long. Gynaecium glabrous, 1.4 mm. long, the subglobose ovary narrowed above into a short thick style; stigma subcapitate. Fruit ellipsoid or subglobose, small, 8–10 mm. in diameter; cupule thick, 4–5 mm. long, 8–11 mm. in diameter, 3 mm. deep inside, the margin entire, truncate, thick. Fruiting pedicel up to 1.2 cm. long and expanded to 5 mm. in diameter at apex.

BRITISH HONDURAS: Toledo District, Botan Creek of the Rio Grande, in cohune ridge on stream bank, May 21, 1944, *Percy H. Gentle 4627*, tree, 7 in. diameter; same locality, in cohune ridge, May 23, 1944, *Gentle 4636* (type), tree, 9 in. diameter, flowers white; Rio Grande, in high ridge, Sept. 18, 1944, *Gentle 4833*, tree, 10 in. diameter, flowers pinkish-white, scented; vernacular name, "wild pear."

The affinity of *N. albiflora* is with *N. globosa* (Aubl.) Mez, but it differs at once in having fewer primary veins of the leaf blade, smaller flowers with stamens and staminodia scarcely more than half as large, ellipsoid or subglobose fruits, and cupule fully 3 mm. deep. In *Gentle 4627*, the leaves are remarkably large, comparable in size to those of *N. Lundellii* Allen.

Nectandra glandulosa Lundell, sp. nov.—Arbor, ramulis crassis, fulvotomentosis. Folia longe petiolata, petiolo ad 1.7 cm. longo; lamina subcoriacea, anguste lanceolata, 9.5–26 cm. longa, 2.5–4.5 cm. lata, apice attenuata, basi acuta, reticulata, nervis 7–11-paribus. Inflorescentia terminalis, paniculata. Pedicelli 3–5 mm. longi. Flores pubescentes, lobis 2.5–3.2 mm. longis. Stamina ca. 1 mm. longa, glandulosa. Ovarium glabrum.

Tree, twigs stout, angled, fulvous-tomentose, the indument becoming thin and appressed on older growth. Leaves petiolate, the petioles flattened, not canaliculate, up to 1.7 cm. long. Leaf blades subcoriaceous, narrowly lanceolate, 9.5–26 cm. long, 2.5–4.5 cm. wide, apex attenuate, the acumen obtusish, base slightly decurrent and recurved, sericeous on both surfaces at first, essentially glabrous at maturity and glossy on the upper surface, persistently barbate in the axils of the primary veins on the undersurface, primary veins strongly ascending, 7–11 on each side, reticulation evident on both surfaces. Inflorescence crowded, forming a leafy terminal panicle, rather thinly tomentose, bractlets persisting until anthesis, lanceolate-elliptic, up to 5 mm. long. Flowers small, in cymes, pubescent. Pedicels slender, 3–5 mm. long. Perianth lobes spreading, rather thin, inconspicuously papillose, oblong-elliptic, 2.5–3.2 mm. long, up to 1.5 mm. wide. Stamens of the two outer series scarcely 1 mm. long, the small quadrate anthers usually longer than filaments, each stamen subtended at base by 1 or 2 fleshy glands. Stamens of third series slightly larger, the subtending glands large, equaling or exceeding the filaments. Staminodia clavate to conspicuously sagittate. Ovary globose, subequaling style. Stigma discoid.

MEXICO: Chiapas, Montecristo, alt. 1350 m., June 17, 1945, *Eizi Matuda 5934* (type).

The species appears to be nearest *N. Matudai* Lundell, but differs at once in its longer slender leaves, longer pedicels, and larger flowers with all stamens bearing glands at the base of the filaments.

Nectandra Matudai Lundell, sp. nov.—Arbor, 14 m. alta, ramulis fulvo-tomentosis, angulatis, crassis. Folia flavida, petiolata, petiolo ad 1.3 cm. longo; lamina chartacea, anguste lanceolato-elliptica vel oblanceolato-elliptica, 8.5–14.5 cm. longa, 3.6–5 cm. lata, apice acuminata, basi subcuneata, reticulata, nervis 5 8-paribus. Inflorescentia axillaris vel subterminalis, tomentella, paniculata, ad 12 cm. longa. Pedicelli ad 2 mm. longi. Flores ca. 3 mm. longi, lobis ad 2.7 mm. longis. Stamina 0.8–1 mm. longa. Ovarium glabrum.

Tree, 14 m. high, buds and twigs fulvous-tomentose with fine subappressed hairs; branchlets rather stout, angled. Leaves yellowish, petiolate, the petioles fulvous-tomentose, up to 1.3 cm. long. Leaf blades thin, chartaceous, narrowly lanceolate-elliptic or oblanceolate-elliptic, 8.5–14.5 cm. long, 3.6–5 cm. wide, apex acuminate and subfalcate, the acumen obtusish, base subcuneate and slightly recurved, fulvous-sericeous on both surfaces at first, glabrous with age except along the costa, midvein slightly impressed above, prominent beneath, primary veins 5–8 on each side, rather conspicuous on both surfaces, strongly ascending, finely reticulate, rather shiny above. Inflorescence axillary and subterminal, tomentellous with fine appressed hairs, paniculate, up to 12 cm. long including peduncle up to 6 cm. long. Pedicels cano-tomentellous, rarely exceeding 2 mm. long. Flowers about 3 mm. long, cano-tomentellous, the perianth lobes up to 2.7 mm. long, narrowly elliptic, narrowed at the base into a short claw, papillose within. Stamens of the two outer series 0.8–0.9 mm. long, the anthers slightly larger than the filaments, quadrate, emarginate. Stamens of third series 1 mm. long, each bearing two large glands at base. Staminodia triquetrous or subulate, about 0.8 mm. long including the filament, pubescent. Gynaecium glabrous, about 1.3 mm. long; ovary globose, slightly longer than the thick style; stigma large, discoid. Fruits unknown.

MEXICO: Chiapas, Malpaso, near Siltepec, in advanced forest, alt. 1000 m., July 21, 1941, *Eizi Matuda 4522* (type), tree, 14 m. high.

This species has been confused with *N. salicifolia* (H.B.K.) Nees to which it only bears a superficial resemblance. Its affinity appears to be with *N. Skutchii* Allen and *N. Standleyi* Allen of Costa Rica.

NECTANDRA RUBRIFLORA (Mez) Allen, Journ. Arn. Arb. 26: 372. 1945. *Ocotea rubriflora* Mez, Jahrb. Bot. Gart. Berlin 5: 279. 1889.

The species, although interpreted by Allen as referable to *Nectandra*, has the cells of the anthers arranged in two planes, one above the other, and perianth lobes erect, not reflexed, at anthesis, characteristics of the genus *Ocotea*.

Allen in the Journ. Arn. Arb. 26: 381 (1945) cites *Percy H. Gentle 2896* from Middlesex, British Honduras, under *Nectandra Lundellii* Allen, but this is obviously a misdetermination. According to the description of *N. rubriflora*, the collection is referable to that species. In *Gentle 2896* the perianth lobes are persistent and indurated, the cupule is up to 1.4 cm. in

diameter and fully 5 mm. deep including the margin, the pedicel is conspicuously enlarged, and the ellipsoid fruits are about 2.5 cm. long, 12 mm. in diameter.

Persea chiapensis Lundell, sp. nov.—Arbor, ad 20 m. alta, ramulis crassis, angulatis, fulvo-tomentellis. Folia petiolata, petiolo crasso ad 2.5 cm. longo; lamina flavida, oblongo-elliptica vel ovato-oblonga, 7–16 cm. longa, 3–7 cm. lata, apice obtusa vel acutiuscula, basi rotundata, supra novella tomentella, subtus dense et minute fulvo-tomentella, nervis 10–12-paribus, subtus elevatis. Inflorescentia axillaris vel subterminalis, subcorymbosa, ad 16 cm. longa, fulvo-tomentella. Pedicelli 1–2.5 mm. longi. Flores ca. 5 mm. longi, lobis exterioribus 2.5–3 mm. longis, interioribus 4–5 mm. longis. Stamina 3 3.5 mm. longa, staminodia ligulata. Fructus globosus, 10–12 mm. diam.

Tree, up to 20 m. high; twigs thick, angled, fulvous-tomentellous; branches almost glabrous with age, brown or dark reddish-brown. Leaves with stout petioles up to 2.5 cm. long. Leaf blades coriaceous, yellowish, paler beneath, oblong-elliptic or ovate-oblong, 7–16 cm. long, 3–7 cm. wide, apex obtuse or acutish, base rounded, the lower surface persistently and minutely fulvous-tomentellous, upper surface sparsely tomentellous or essentially glabrous with age, primary veins 10–12 on each side, plane above, prominent on undersurface, widely ascending, openly reticulate beneath, the midvein broad and plane on upper surface, elevated on undersurface. Inflorescence axillary and subterminal, subcorymbose, sometimes up to 16 cm. long, usually not over 12 cm. long, persistently fulvous-tomentellous, the flowers crowded. Pedicels 1–2.5 mm. long, stout. Flowers fulvous-tomentellous, about 5 mm. long, the perianth lobes ovate, unequal, the outer 2.5–3 mm. long, the inner 4–5 mm. long, acutish, the veins conspicuous. Stamens of two outer series 3–3.5 mm. long, the filaments slightly shorter than the anthers, pubescent, the anthers oblong-elliptic, slightly emarginate, sparsely hairy, the cells in two planes, touching at the sides. Stamens of inner series 3–3.5 mm. long, pubescent, the glands borne above the base. Staminodia pubescent, ligulate, 1–1.3 mm. long. Gynaecium glabrous, 3–4 mm. long, the style slightly exceeding ovary, stigma capitate. Fruit globose, blue-black, 10 12 mm. in diameter; perianth lobes persistent; fruiting pedicel only slightly enlarged.

MEXICO: Chiapas, Niquihuil, near Motozintla, in virgin forest, alt. 2786 m., May 15, 1945, *Eizi Matuda 5498* (type), tree, 15–20 m. high; Carelas, near Motozintla, in virgin forest, alt. 2176 m., April, 1945, *Matuda 5526*, tree, 8–10 m. high.

The species appears to be related to *P. Liebmanni* Mez of Oaxaca. Its yellowish leaves give it a superficial resemblance to *P. flavifolia* Lundell.

On the basis of the strongly unequal perianth lobes, style longer than the ovary, and globose fruits subtended by persistent perianth lobes, the species is definitely a *Persea*. The staminodia are ligulate rather than cordate, but other species of the genus are so characterized. Variations in

the staminodia are neither as important nor as dependable for indicating generic status in the LAURACEAE as some authorities on the family imply.

Persea chrysobalanoides Lundell, sp. nov.—Arbor, 9–10 m. alta, ramulis minute cano-sericeis, crassis. Folia petiolata, petiolo crasso ad 2 cm. longo; lamina coriacea, glabra, elliptica vel obovato-elliptica, 9.5–18 cm. longa, 5.5–10.3 cm. lata, apice rotundata, basi rotundata et subacuta, nervis 10–16 paribus, subtus elevatis, reticulatis. Inflorescentia axillaris, paniculata, ad 21 cm. longa, minute sericea. Flores ca 4.5 mm. longi, lobis ovatis, 3–3.2 mm. longis. Stamina 1.4–2 mm. longa, staminodia sagittata. Fructus ignotus.

Tree, 9–10 m. high; twigs thick, angled, minutely cano-sericeous; branches grayish. Leaves with stout broad petioles up to 2 cm. long. Leaf blades coriaceous, minutely cano-sericeous over the lower surface at first, entirely glabrous with age, elliptic or obovate-elliptic, 9.5–18 cm. long, 5.5–10.3 cm. wide, apex rounded, base rounded and decurrent, veins plane but conspicuous on upper surface, prominent and openly reticulate on undersurface, primary veins 10–16 on each side, ascending at a wide angle. Inflorescence axillary, paniculate, narrowly pyramidal, longer than the leaves, up to 21 cm. long including peduncle up to 7.5 cm. long, minutely sericeous. Pedicels very short, 1–2 mm. long. Flowers crowded, cano-sericeous, about 4.5 mm. long, the perianth lobes subequal, ovate, 3–3.2 mm. long, obtuse, deciduous. Stamens of two outer series 1.4–1.8 mm. long, pubescent, the anthers ovoid, rounded or subtruncate at apex, the cells touching at the sides. Stamens of inner series 2 mm. long, with two large glands at base. Staminodia sagittate, 1 mm. long including the pubescent stipe. Gynaecium glabrous, the thick style slightly longer than the ovary, stigma discoid.

MEXICO: Chiapas, La Grandeza, in virgin forest, alt. 2016 m., May 19, 1945, *Eizi Matuda 5582* (type), tree, 9–10 m. high.

The relationship of the species is not clear, but it appears to have affinity to *P. pallida* Mez & Pitt. and *P. rigens* Allen of Costa Rica.

Phoebe siltepecana Lundell, sp. nov.—Arbor, ad 10 m. alta, ramulis minute cano-sericeis. Folia petiolata, petiolo minute sericeo, ad 1.3 cm. longo; lamina subchartacea, lanceolata vel lanceolato-elliptica, 6.5 12.5 cm. longa, 1.8–4 cm. lata, apice subabrupte acuminata, basi acuta, glabrata, reticulata, nervis 5–8-paribus. Inflorescentia axillaris vel subterminalis, ad 6 cm. longa, parce sericea. Pedicelli ad 5 mm. longi. Flores ca. 5 mm. longi, lobis anguste oblongo-ellipticis, 3–4 mm. longis. Stamina 1.7–2 mm. longa, staminodia subcordata. Ovarium glabrum. Fructus ellipsoideus, ad 1.6 cm. longus.

Tree, up to 10 m. high; buds cano-sericeous; twigs slender, angulate, very minutely but densely sericeous, black-gray, silvery. Leaves slenderly petiolate, the petioles minutely sericeous, subterete, up to 1.3 cm. long. Leaf blades thin, subchartaceous, slightly paler beneath, lanceolate or

lanceolate-elliptic, 6.5–12.5 cm. long, 1.8–4 cm. wide, apex acuminate, often subfalcate, base acute, sericeous at first along the costa and primary veins on both surfaces, midvein slightly impressed above, reddish-brown and elevated on undersurface, primary veins 5–8 on each side, subimpressed above, prominent and reddish-brown beneath, reticulate on both surfaces but conspicuously so on the undersurface. Inflorescence axillary or subterminal, the subtending leaves deciduous early leaving a naked branch, racemose, up to 6 cm. long, drying black, sparsely sericeous. Pedicels slender, up to 5 mm. long, sparsely sericeous. Flowers white, sparsely sericeous, about 5 mm. long, the lobes patent or reflexed at anthesis, narrowly oblong-elliptic, 3–4 mm. long, equal. Stamens of the two outer series up to 1.8 mm. long, the filaments short, adhering to the perianth lobes, anthers ovate-elliptic, suborbicular or quadrate with rounded apex, up to 1.5 mm. long, with little connective at apex. Stamens of the third series 1.7–2 mm. long, with large sessile glands at base, the anthers oblong, truncate at apex. Staminodia large, subcordate, about 1 mm. long including the short filament. Gynaecium glabrous, the ovary globose; the style thick, shorter than the ovary; the stigma large. Fruits ellipsoid, up to 1.6 cm. long, drying black and glossy. Cupule about 5.5 mm. in diameter, scarcely 2 mm. deep, the margin entire. Fruiting pedicels 5–7 mm. long, enlarged, about 2.5 mm. in diameter at apex.

MEXICO: Chiapas, Cascada near Siltepec, in forest, alt. 1600 m., March 1, 1945, *Eizi Matuda 5140* (type), tree, 8–10 m. high, flowers white; same locality and date, *Matuda 5175*, tree, 5–6 m. high.

P. siltepecana is nearest *P. acuminatissima* Lundell of the same region, differing at once from the latter in its larger coarser veined leaves and larger flowers which differ in structure. Both have similar sericeous indument. In *P. acuminatissima* the leaves are narrowly lanceolate and attenuate at apex, while in *P. siltepecana* they are more elliptic and subabruptly acuminate.

Lonchocarpus chiapensis Lundell, sp. nov.—Arbor parva, 7–8 m. alta; ramulis glabratis. Folia 7–9 raro 3-foliolata. Foliola subchartacea, elliptica vel obovato-elliptica, 4.5–9.5 cm. longa, 3.3–5.6 cm. lata, apice subabrupte acuminata, basi rotundata vel acutiuscula, supra glabrata, subtus novella strigillosa. Inflorescentiae longe racemosae, ad 21 cm. longae, axillares. Pedicelli fructiferi 4.5–7 m. longi. Calyx cupulatus, 2.5–3 mm. longus, truncatus. Legumen 1–4-spermum.

Small tree, 7–8 m. high; twigs glabrescent, rather slender. Leaves usually 7–9-foliolate, sometimes only 3-foliolate, the rachis and petiole together up to 17 cm. long, slender, glabrescent. Leaflets subchartaceous; petiolules slender, 5–6 mm. long; blades of lateral leaflets elliptic or obovate-elliptic, 4.5–9 cm. long, 3.3–4.7 cm. wide, the terminal obovate-elliptic, up to 9.5 cm. long, 5.6. cm. wide, apex subabruptly acuminate, the acumen obtusish, base rounded or acutish, the sides of lateral leaflets subequal, strigillose at first, the upper surface glabrescent early, minutely punctate,

slightly paler on the undersurface, primary veins 7–9 on each side, slender, strongly ascending, with age slightly impressed on the upper surface, costa elevated on undersurface. Racemes axillary, 7.5–21 cm. long, the rachis rather stout; peduncles 2-flowered, stout in fruit, 2.5–4 mm. long, glabrous. Pedicels of fruits 4.5–7 mm. long, thickened at base of calyx, bearing 2 minute bracteoles about the middle. Persistent calyx cupulate, 2.5–3 mm. long, evidently truncate, glabrous. Legume thin, flat, sparsely strigillose at first, elliptic when 1-seeded, oblong when 2–4-seeded, up to 11 cm. long, 2.7 cm. wide, base short stipitate, apex rounded and abruptly acute, the style base persistent.

MEXICO: Chiapas, Pinuela near Escuintla, in secondary growth, elev. 700 m., February 19, 1945, *Eizi Matuda 5008* (type).

L. chiapensis and *L. nicaraguensis* Lundell both evidently have affinity to *L. Michelianus* Pittier of Guatemala.

In *L. chiapensis* the long racemes and the slender elongated leaf rachis with widely spaced leaflets give the species a unique appearance.

Lonchocarpus hidalgensis Lundell, sp. nov.—Arbor; ramulis ferrugino-pubescentibus. Folia 13–17-foliolata. Foliola chartacea, oblongo-elliptica vel anguste elliptica, 1 3.5 cm. longa, 0.7–1.3 cm. lata, raro ad 4.5 cm. longa, 1.5 cm. lata, apice obtusa vel rotundata, minute apiculata, basi obtusa, costa et nervis impressis. Inflorescentiae racemosae, axillares. Pedicelli ca. 4 mm. longi. Calyx ferrugino-pubescentibus, cupulatus, ca. 3 mm. longus, 5-dentatus.

Tree; twigs rather slender, densely pubescent with short ferruginous hairs, glabrescent early. Leaves 13–17-foliolate, the rachis up to 12 cm. long, puberulent with ferruginous hairs. Leaflets chartaceous; petiolules up to 3 mm. long; blades oblong-elliptic or narrowly elliptic, 1–3.5 cm. long, 0.7–1.3 cm. wide, the terminal sometimes 4.5 cm. long, 1.5 cm. wide, apex obtuse or rounded, minutely apiculate, base obtuse, the sides equal or subequal, pubescent on both surfaces with short fine hairs, primary veins 5–7 on each side, the veins and midrib impressed on upper surface, conspicuous on lower surface, reticulation inconspicuous. Racemes axillary, 4–10 cm. long, pubescent with short fine crinkled ferruginous hairs. Peduncles usually 2-flowered, about 1 mm. long. Pedicels about 4 mm. long, bearing 2 narrow bractlets above the middle. Calyx ferruginous-pubescent, cupulate, scarcely 3 mm. long, 5-dentate. Blade of standard petal 8 mm. long, the claw 2 mm. long, shallowly bilobed at base, sericeous on outside; wings with blade 7 mm. long, about 3 mm. wide, auriculate at base, the claw 3 mm. long; carinal petals cohering above middle, 9 mm. long including claws 3 mm. long. Vexillar stamen free at base. Immature legume densely pubescent with subappressed ferruginous hairs, oblong, thin, acute at apex, the style persistent.

MEXICO: Hidalgo, Jacala, rocky mountain side, July 7, 1939 *V. H. Chase 7337* (type).

The relationship of the species is with *L. rugosus* Benth. from which it is distinguished by the axillary racemes, smaller narrower leaflets, finer shorter pubescence of all parts, longer pedicels, and acute legumes. In *L. hidalgensis* the petals are slightly larger than in *L. rugosus* as described by Pittier in Contr. U. S. Nat. Herb. 20: 54 (1917). *L. hidalgensis* also has affinity to *L. Gillyi* Lundell, but the more numerous primary veins and the rounded rather than obtuse apex of the leaf blade in *L. Gillyi* immediately distinguish it.

Lonchocarpus nicaraguensis Lundell, sp. nov.—Arbor parva, 3 m. alta, 10 cm. diam.; ramulis strigillosis. Folia 5–7-foliolata. Foliola chartacea, elliptica, ovato-elliptica, obovato-elliptica, vel late obovata, 4.5–10 cm. longa, 2.5–6 cm. lata, apice subabrupte acuminata, basi obtusa vel rotundata, supra glabra, subtus strigillosa. Inflorescentiae racemosae, axillares. Pedicelli fructiferi ca. 3 mm. longi. Calyx cupulatus, ca. 2.5 mm. longus. Legumen 1–2-spermum.

A small tree, 3 m. high, 10 cm. in diameter; twigs, petioles and inflorescence strigillose, the twigs glabrescent early. Leaves 5–7-foliolate, the rachis and petiole together 4.5–14 cm. long. Leaflets chartaceous; petiolules 3–6.5 mm. long; blades of lateral leaflets elliptic, ovate-elliptic or obovate-elliptic, 4.5–10 cm. long, 2.5–5 cm. wide, the terminal obovate-orbicular, up to 6 cm. wide, apex rather abruptly short acuminate, the acumen obtusish, base obtuse or rounded, the sides subequal, essentially glabrous on upper surface, persistently strigillose on lower surface, venation conspicuous, primary lateral veins approximate, strongly ascending, 10–12 on each side, inconspicuously impressed on upper surface. Racemes axillary, 3–7 cm. long; peduncles evidently 2-flowered, stout in fruit, 1.5–2.5 mm. long, gray-strigillose. Pedicels of fruits stout, about 3 mm. long, bearing 2 bracteoles at the middle. Persistent calyx cupulate, gray-strigillose, about 2.5 mm. long. Legume thin, sparsely strigillose at first, oblong, constricted between the seeds, up to 8 cm. long (immature), 2.8 cm. wide, 1- or 2-seeded, acute at apex, acute or attenuate at base.

NICARAGUA: Department of Managua, Lago de Nejapa, elev. 400 feet, January 19, 1945, *S. S. White & C. L. Gilly, Sr. 5365* (type), tree, 3 m. tall; same locality and date, *White & Gilly 5361*, sprouts 1 m. tall from stump 15 cm. in diameter; Department of Rivas, near Tola, Finca Coacajoche, elev. 100 feet, January 16, 1945, *White & Gilly 5350*, tree, 10 cm. in diameter; vernacular name, "chaperno blanco."

Lonchocarpus Whitei Lundell, sp. nov.—Arbor parva, 4 m. alta, 20 cm. diam.; ramulis strigillosis. Folia 5–9-foliolata. Foliola chartacea, lanceolata, elliptica, elliptica-oblonga, oblanceolata vel suborbicularis, 1–8.5 cm. longa, 0.8–3.7 cm. lata, apice breviter acuminata, acuta, obtusa vel rotundata, basi acuta, obtusa vel rotundata, strigillosa. Inflorescentiae racemosae, axillares. Pedicelli fructiferi ad 1.2 mm. longi, strigillosi. Calyx cupulatus, 1–1.3 mm. longus. Legumen 1-spermum, longistipitatum, strigillosum, ad 4.5 cm. longum, 1.2 cm. latum.

A small tree, 4 m. high, 20 cm. in diameter; twigs strigillose, drying angled. Leaves 5–9-foliolate, the rachis and petiole together 1.5–8 cm. long, strigillose. Leaflets chartaceous, drying grayish-green; petiolules 1–3 mm. long; blades of lateral leaflets lanceolate, elliptic, elliptic-oblong or suborbicular, 1–6.8 cm. long, 0.8 2.3 cm. wide, the terminal ones lanceolate, oblanceolate or elliptic, up to 8.5 cm. long, 3.7 cm. wide, apex short acuminate, acute, obtuse or rounded, base acute to rounded, the sides unequal, strigillose on both surfaces, the hairs sometimes suberect on upper surface, venation evident but fine and inconspicuous, the primary veins strongly ascending, 5 11 on each side, costa elevated on undersurface. Racemes axillary, reflexed, 2.5 7.5 cm. long; peduncles evidently 2-flowered, about 1 mm. long, strigillose. Pedicels of fruits stout, up to 1.2 mm. long, strigillose. Persistent calyx cupulate, strigillose, 1 1.3 mm. long, subentire. Legume flat, thin, 1-seeded, borne on a long slender stipe up to 8 mm. long, the body of legume oblong-lanceolate or oblanceolate, up to 4.5 cm. long (almost mature), up to 1.2 cm. wide, apex rounded to acute, apiculate, base attenuate into the stipe, strigillose.

NICARAGUA: Department of Rivas, near Tola, Finca Coacajoche, elev. 100 feet, January 16, 1945, *S. S. White & C. L. Gilly, Sr. 5357*, small tree, 3 m. high, vernacular name, "chaperno negro"; Department of Masaya, between Masatepe and Masaya, elev. 1400 feet, January 19, 1945, *White & Gilly 5367*, small tree, 2 m. high; Department of Chinandega, along Rio Acome, edge of City of Chinandega, elev. 75 feet, January 24, 1945, *White & Gilly 5385* (type), tree, 4 m. high, 20 cm. in diameter, vernacular name, "chaperno"; along Rio Acome, elev. 75 feet, January 24, 1945, *White & Gilly 5387*, small tree.

Celastrus siltepecanus Lundell, sp. nov.—Frutex scandens. Folia breviter petiolata, petiolo crasso, canaliculato, 4–7 mm. longo; lamina coriacea, obovato-elliptica vel oblanceolato-elliptica, 6–12 cm. longa, 2.2 5.2 cm. lata, apice subacuminata, acumine obtuso, basi rotundata, crenata. Inflorescentiae racemosae, axillares, ad 6 cm. longae. Pedicelli 2–14 mm. longi. Petala 5, ovato-lanceolata, ca. 2.5 mm. longa. Filamenta subulata, 2 mm. longa. Ovarium 3-loculare, loculis uniovulatis.

Woody vine, glabrous; twigs drying reddish, conspicuously lenticillate. Leaves alternate, short petiolate, the petioles stout, canaliculate, 4 7 mm. long. Leaf blades coriaceous, obovate-elliptic or oblanceolate-elliptic, 6 12 cm. long, 2.2 5.2 cm. wide, apex subabruptly short acuminate, the acumen obtuse, base rounded, margin crenulate or crenate, venation conspicuous on both surfaces, midvein plane above, elevated beneath, primary veins 7–11 on each side, essentially plane on the upper surface, elevated on the undersurface, veins reticulate on both surfaces. Inflorescence axillary, racemose, solitary or fasciculate, floriferous to the base; the rachis slender, up to 6 cm. long. Bractlets lanceolate-subulate, up to 1.5 mm. long. Pedicels slender, 2–14 mm. long, jointed near the middle. Calyx 5-lobed, the lobes ovate-triangular, rounded at apex, 0.8–1.2 mm. long, slightly accrescent. Petals 5, reflexed, ovate-lanceolate, about 2.5 mm. long. Filaments subulate, 2 mm. long, borne between the lobes of the disk. Disk flat, annular, thick,

5-lobed. Ovary 3-celled, with 1 erect ovule in each cell. Style thick, short, persistent at the apex of immature fruits. Capsules apparently 1-seeded.

MEXICO: Chiapas, Fraylesca near Siltepec, in woodland, alt. 1600 m., March 6, 1945, *Eizi Matuda 5192* (type).

C. siltepecanus has the conspicuously lenticillate twigs of *C. lenticellatus* Lundell, but it differs notably otherwise in the coriaceous crenate leaves, shorter petioles, and few-flowered racemose inflorescences. In *C. lenticellatus* the inflorescence is paniculate and many-flowered.

In the elongated pedicels of the infructescence, *C. siltepecanus* resembles *C. longipes* Lundell of Durango. In *C. longipes* the pedicels are jointed at the apex.

Maytenus chiapensis Lundell, sp. nov.—Arbor parva, 3–4 m. alta; ramulis glabris, angulatis. Folia glabra, petiolata, petiolo 3–6 mm. longo; lamina coriacea, anguste oblonga, oblanceolata vel anguste elliptica, 4.5–8.5 cm. longa, 1.2–3.5 cm. lata, apice attenuata, obtusa, basi cuneata. Flores fasciculati. Pedicelli fructiferi 5–8 mm. longi. Capsula subglobosa, ad 1.3 cm. longa, glabra.

Small tree, 3–4 m. high; twigs glabrous, rather slender, angled. Stipules triangular, 0.8–1.2 mm. long, acute, the margin short fimbriate. Leaves glabrous, petiolate, the petioles canaliculate, 3–6 mm. long; leaf blades coriaceous, ashy-green, narrowly oblong, oblanceolate or narrowly elliptic, 4.5–8.5 cm. long, 1.2–3.5 cm. wide, apex attenuate, obtuse, inconspicuously emarginate, base cuneate, costa elevated as a narrow ridge on upper surface, the venation otherwise inconspicuous, primary lateral veins up to 9, irregular, margin inconspicuously crenulate. Flowers fasciculate in the leaf axils. Fruiting pedicels stout, straight, 5–8 mm. long. Capsules 2-celled, subglobose, up to 1.3 cm. long, glabrous, 1-seeded.

MEXICO: Chiapas, Pinuela near Escuintla, in secondary growth, elev. 700 m., February 19, 1945, *Eizi Matuda 5011* (type).

The narrow leaves attenuate to the obtuse apex, long pedicels, and comparatively large capsules characterize the species.

The affinity of *M. chiapensis* is with *M. Purpusii* Lundell, *M. Schippii* Lundell, *M. guatemalensis* Lundell, and *M. belizensis* Standl. The inadequacy of available herbarium material precludes a critical evaluation of these entities, but they are obviously very closely allied.

Microtropis areolata Lundell, sp. nov.—Arbor parva, 8–10 m. alta, ramulis rubris, glabris. Folia opposita, glabra, petiolata, petiolo crasso, 3–6 mm. longo; lamina coriacea, anguste elliptica vel lanceolata, 2–6.5 cm. longa, 1.2–2.7 cm. lata, apice acuta vel obtusiuscula, basi acuta, supra areolata. Cymae parvae, ad 1.8 cm. longae. Capsula ovoideo-ellipsoidea, ca. 1.2 cm. longa, apiculata.

Small tree, 8–10 m. high; twigs short, drying dark red and striate, glabrous. Leaves decussately opposite, glabrous; petioles rather stout, canaliculate, 3–6 mm. long; leaf blades firmly coriaceous, dark green above,

paler beneath, narrowly elliptic or lanceolate, 2–6.5 cm. long, 1.2–2.7 cm. wide, apex acute or obtusish, base acute, midvein elevated on both surfaces, upper surface conspicuously areolate, the veins impressed, primary veins 4–6 on each side, arcuately ascending, evident but not conspicuous on undersurface, obscurely reticulate, margin entire. Cymes small, less than 2 cm. long including fruits, divaricately forked 1 or 2 times, each node bibracteate; peduncles stout, 3 4 mm. long; primary branches 2–2.5 mm. long. Bractlets erose-denticulate, rigid, persistent. Calyx persistent at base of fruits, sepals 5. Capsules ovoid-ellipsoid, about 1.2 cm. long, apiculate, coriaceous, 2-valved, 1-celled, 1-seeded, the seed orange-red.

GUATEMALA: Department of El Progreso, between Finca Piamonte and top of Montaña Piamonte, along Joya Pacayal, on summit, alt. 2500–3000 m., Feb. 7, 1942, *Julian A. Steyermark 43676* (type), tree 30 ft. tall, leaves firmly subcoriaceous, dark green above, pale green beneath, outside of fruit pale green, ovoid, inside vermilion-orange; hills north of Finca Piamonte, between Finca Piamonte and summit of Volcan Santa Luisa, in cloud forest on top, alt. 2400–3333 m., Feb. 5, 1942, *Steyermark 43548*, small tree 25 ft. tall, leaves subcoriaceous, dull green and areolate-veined above, silvery green beneath.

Among the American species, *M. areolata* is the only one with the upper surface of the leaves areolate. It is characterized further by inflorescences reduced at times to cymes bearing only 1 or 2 flowers. From the scanty material available, the species appears to be nearest *M. guatemalensis* Sprague.

Microtropis contracta Lundell, sp. nov.—Frutex vel arbor parva, ramulis glabris, atro-rubris. Folia opposita, glabra, petiolata, petiolo crasso, 3–4 raro 5 mm. longo; lamina coriacea, elliptica, 2 7 cm. longa, 0.8–3.1 cm. lata, apice obtusa vel acutiuscula, basi acuta. Cymae contractae, capitatae, ad 1 cm. longae. Pedunculi 1.5–3, raro 4 mm. longi, 1- vel 2-dichotomi. Capsula immatura oblongo-ellipsoidea, ad 1.7 cm. longa, acuta.

Shrub or small tree, 7–10 m. high; twigs glabrous, rather short and stout, drying dark red, angled, subcompressed at the nodes, the internodes usually short. Leaves decussately opposite, glabrous; petioles stout, canaliculate, 3–4, rarely up to 5 mm. long; leaf blades firmly coriaceous, lower surface somewhat paler than upper surface, elliptic, 2–7 cm. long, 0.8 3.1 cm. wide, apex obtuse or acutish, base acute, the margin often revolute, midvein elevated on both surfaces, prominent on undersurface, primary veins 5 or 6 on each side, nearly horizontal, conspicuous on undersurface, scarcely evident on upper surface. Cymes 3–5-flowered, reduced, in flower less than 1 cm. long, divaricately forked 1 or 2 times, the flowers sessile, each node bibracteate; peduncles stout, 1.5–3, rarely 4 mm. long; primary branches contracted, usually less than 1 mm. long, crowding the flowers into a head. Bractlets large, ovate-oblong, keeled, rigidly coriaceous, apiculate, erose, persistent. Flowers tetramerous or pentamerous. Calyx lobes coriaceous, depressed-orbicular, the margin hyaline, erose. Petals suborbicular, up to 2.5 mm. long. Disk thick, saucer-shaped, about 2.5 mm. in diameter.

Filaments borne on rounded shallow lobes of the disk, about 0.6 mm. long. Anthers about 0.7 mm. long. Ovary submerged in disk, abruptly contracted above into a conical style, 2-celled. Immature capsules oblong-ellipsoid, up to 1.7 cm. long, acute.

MEXICO: Chiapas, Mt. Paxtal, Dec. 30, 1936 *Eizi Matuda 450* (type). GUATEMALA: Department of Huehuetenango, Cerro Pixpix, above San Ildefonso Ixtahuacan, in moist forest on summit, alt. 1600–2800 m., Aug. 15, 1942, *Julian A. Steyermark 50655*, tree, 30 ft. tall, leaves dark green and shining above; above Macx, between Todos Santos and San Martin, Sierra de los Cuchumatanes, in moist mixed forest of *Quercus*, *Abies* and *Pinus*, alt. 2500–3000 m., Sept. 6, 1942, *Steyermark 51924*, shrub, 20 ft. tall, leaves subcoriaceous, pale green beneath, vernacular name, "shiorsh."

M. contracta is near *M. guatemalensis* Sprague, but differs in having elliptic rather than oblanceolate leaves, and sharply contracted and reduced inflorescences with the flowers crowded into a head. The peduncle in *M. contracta* does not exceed 4 mm. in length, and the primary branches are scarcely discernible. The length of the immature capsules is exceptional.

Microtropis stipitata Lundell, sp. nov. (Fig. 3)—Frutex vel arbuscula gracilis, ca. 5-metralis, ramulis glabris, rubris. Folia opposita, glabra, petiolata, petiolo 5–13 mm. longo; lamina membranacea, elliptica, 5–12 cm. longa, 2–4.5 cm. lata, apice breviter acuminata, basi acuta. Cymae ad 2.5 cm. longae. Pedunculi ad 8 mm. longi, 1–3-dichotomi. Capsula flavida, ca. 1 cm. longa, stipitata.

Arborescent shrub or small tree, about 5 m. high, 4 cm. in diameter; twigs dark red, somewhat flattened at the nodes, drying striate, glabrous. Leaves decussately opposite, glabrous; petioles slender, canaliculate, 5–13 mm. long; leaf blades membranaceous, dark green above, paler beneath, elliptic, 5–12 cm. long, 2–4.5 cm. wide, apex short acuminate, base acute, venation inconspicuous, primary veins 3–6 on each side, arcuately ascending, very slender, midvein slightly elevated on upper surface, prominent on undersurface, margin entire. Cymes (in fruit) up to 2.5 cm. long, divaricately forked 1–3 times, each node bibracteate; peduncles up to 8 mm. long; primary branches up to 3 mm. long. Bractlets with erose-denticulate margin. Calyx persistent at base of fruit, sepals 5, unequal, depressed-orbicular, 1.2–2.2 mm. wide, imbricate. Capsules yellowish, pyriform, about 1 cm. long, coriaceous, stipitate, 2-valved, 1-celled, 1-seeded, the seed bright red.

MEXICO: Puebla, mountains west of Huauchinango, in wet *Podocarpus* forest, Nov. 1, 1943, *C. L. Lundell 12632* (type).

This graceful arborescent shrub is nearest *M. occidentalis* Loes., but may be distinguished at once from that species by its smaller stipitate fruits. *M. occidentalis* is not known to occur outside of Costa Rica.

Another Mexican collection, *Schiede*, Sept., 1829, Cumbre del Obispo, between Papantla and Misantla, Vera Cruz, appears to be referable here.

Fig. 3. *Microtropis stipitata* Lundell. a, branch, ×½; b, capsule with persistent calyx at base (note the stipe), ×2½. Drawn from the type collection, *C. L. Lundell 12632*. Illustrated by Eduardo Salgado.

This collection was tentatively referred to *M. occidentalis* in my revision of the American species of the genus in Contr. Univ. Mich. Herb. 3: 32 (1939).

Parathesis platyphylla Lundell, sp. nov.—Arbor parva, 7.5 cm. diam., ramulis brunneo-lepidotis. Folia petiolata, petiolis ad 2.5 cm. longis, marginatis; lamina chartacea, oblongo-elliptica vel lanceolato-elliptica, ad 8 cm. lata, 25 cm. longa, apice acuminata, basi attenuata, supra glabra, subtus minute stellato-lepidota, obscure crenulata. Inflorescentiae terminales, paniculatae, ad 19 cm. longae, brunneo-lepidotae. Flores corymbosi. Pedicelli ad 5 mm. longi. Sepala ca. 1.7 mm. longa, acuta. Petala anguste lanceolata, ca. 5 mm. longa. Antherae 2.2 mm. longae, punctatae. Fructus globosus, 8 mm. diam.

A small tree, 7.5 cm. in diameter; twigs brown-lepidote. Petioles up to 2.5 cm. long, stout, canaliculate, marginate. Leaf blades chartaceous, oblong-elliptic or lanceolate-elliptic, up to 8 cm. wide, 25 cm. long, apex acuminate, base attenuate, decurrent, minutely stellate-lepidote on undersurface at first, glabrous above, primary veins 14-17 on each side, slightly impressed on upper surface, margin minutely and inconspicuously crenulate. Inflorescence leafy, terminal, large, paniculate, up to 19 cm. long, the terminal branches horizontal, brown lepidote with minute stellate hairs. Flowers red, corymbose, borne on pedicels up to 5 mm. long, the minute indument reddish-brown; buds 5 mm. long at anthesis. Sepals triangular, acute, about 1.7 mm. long. Petals narrowly lanceolate, about 5 mm. long, reflexed, coherent at base, black-punctate. Filaments short, about 1.2 mm. long. Anthers conspicuously black-punctate, 2.2 mm. long. Ovary pubescent at apex. Style glabrous, about 4 mm. long. Fruits globose, drying 8 mm. in diameter.

BRITISH HONDURAS: El Cayo District, Vaca, at base of hill, May 13, 1938, *Percy H. Gentle 2615* (type), a tree, 3 inches in diameter, flowers red; same locality, at edge of creek, April 4, 1938, *Gentle 2443*, small tree, 1½ inches in diameter, 10 feet high.

Although similar to *P. serrulata* (Swartz) Mez, to which it has close affinity, *P. platyphylla* differs notably in its much wider leaves and larger flowers and fruits.

A USEFUL METHOD FOR DRYING PLANT SPECIMENS IN THE FIELD

Cyrus Longworth Lundell

A safe source of slow heat, readily available under all field conditions, is desirable for the proper curing of herbarium specimens. In the wet tropics artificial heat is indispensable to a collector, and its use by botanists even in desert areas is widespread.

A regulated amount of heat is essential to cure specimens slowly, for slow drying not only preserves the plant color, but gives a specimen which will hold up indefinitely. Excessive and unregulated heat, such as that which results from the use of popular charcoal driers, scorches material making it so brittle that disintegration is rapid.

In 1931 while carrying out vegetation studies at Tuxpeña in Campeche, Mexico, kerosene lanterns were first utilized in the drying of herbarium specimens. Ever since their first use, they have been found entirely dependable even in wet tropical forest under the most trying circumstances.

The kerosene lantern, handled with moderate care, is ideal for the drying of material, its only objection being bulkiness. By varying the number of lanterns under a press, and by regulating the height of the flame, the desired amount of heat can be obtained. Adjusted to a moderate flame, seven lanterns will burn continuously for a week on five gallons of kerosene.

Figures 4 and 5, based on photographs taken in 1936 in British Honduras, illustrate the method of drying in which lanterns are used. The prepared specimens are placed in presses between stiff double-faced corrugated boards, with the corrugations in direct contact with the sheets containing the plant material. In outdoor camps, the frame supporting the presses is made of forked sticks and poles as illustrated. The boxes in which the kerosene tins are shipped serve admirably for end supports of the poles where the use of forked sticks is not feasible. In field work in Texas and northern Mexico, a collapsible frame made specifically for the purpose has proven very satisfactory, for it can be set up in garages of tourist courts, or in other available space.

A canvas skirt with drawstring at the top is placed around the entire drier as shown in fig. 5. Care must be taken not to cover the top, for the continuous passage of hot air through the hundreds of openings formed by the corrugations is essential. In this way most of the specimens can be cured and dried within 24 hours.

The demonstrated practicality of the method justifies its widespread use.

Fig. 4. Plant drier with canvas skirt pulled aside to show presses, frame and lanterns.

Fig. 5. Plant drier with canvas skirt in place. Note that ample space is left at top to permit the hot air to pass through the corrugated boards.

NOTES

The accessions of the herbarium of Southern Methodist University in 1944–1945 included 14,223 specimens received on exchange and 17,340 specimens obtained through purchases, gifts, and staff collections, a total of 31,563 sheets.

A set of 633 specimens, primarily representing early Texas collections of Charles Wright, S. B. Buckley and F. J. Lindheimer, was generously made available on exchange by Mr. A. M. Fuller of the Milwaukee Public Museum. This material, of great historical interest, was part of the Dapprich Herbarium.

Equally valuable historic material of North American grasses was selected by Mrs. Agnes Chase and made available through the United States National Herbarium. A set of 4380 specimens of the G. B. Hinton collection, received on exchange from the New York Botanical Garden, was the outstanding addition of the year to the Mexican collection.

NEWS

On February 4, 1946, Mrs. W. W. Fondren of Houston announced the gift of $1,000,000 to Southern Methodist University for the erection of a science building.

Mr. V. L. Cory, who retired as Range Botanist of the Texas Agricultural Experiment Station on September 1, 1945, has been appointed Field Botanist in the Institute of Technology and Plant Industry. At Southern Methodist University he will participate in the plant resources survey of Texas which has as its ultimate purpose the discovery of new sources of useful plant products. In connection with this work, he will collect extensively for the herbarium.

Dr. Lloyd H. Shinners, Research Fellow in the Institute, left Dallas for Washington on December 24 to spend three months at eastern herbaria. He is studying types of North American COMPOSITAE.

As a collaborator in the study of the flora of Texas, Dr. Eula Whitehouse is making extensive collections along the Red River of Texas in Wichita, Wilbarger and adjacent counties. During the summer of 1945, Dr. Whitehouse was technical assistant in the herbarium.

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EDITOR

CYRUS LONGWORTH LUNDELL

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WRIGHTIA

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A NEW SPECIES OF DRACOCEPHALUM L. FROM TEXAS

CYRUS LONGWORTH LUNDELL

Colorful wild flowers, such as species of *Dracocephalum* and *Phlox*, are often neglected by professional botanists in their explorations, the assumption being that these are taken by every collector. Recent attention to such groups in Texas has revealed a number of interesting species, and intensive field studies will certainly yield additional novelties.

Among the attractive wild flowers recently discovered is a new species of *Dracocephalum* found by Dr. D. S. Correll in Val Verde County in 1946. In recognition for the critical work which he is doing on the flora of Texas, it is a pleasure to name this plant for the collector.

Dracocephalum Correllii Lundell, sp. nov.—Herba, ad 120 cm. alta, ramulis glabris. Folia sessilia, membranacea, serrato-dentata, elliptica vel oblongo-elliptica, 5–13 cm. longa, 2–6.5 cm. lata, apice subacuminata. Inflorescentiae parvae, racemosae, puberulae. Pedicelli fructiferi ca. 1 mm. longi. Calyx 8–9.5 cm. longus. Corolla ca. 3 cm. longa.

Plants erect, up to 120 cm. high; stems simple or sparingly branched, 4-angled, glabrous. Leaves decussately opposite, sessile. Leaf blades thin, membranaceous, elliptic or oblong-elliptic, 5–13 cm. long, 2–6.5 cm. wide, apex short acuminate, base slightly narrowed, inconspicuously clasping, margin conspicuously and sharply serrate-dentate to base, primary veins usually 2 or 3 on each side, upper leaves only slightly reduced. Racemes spike-like, simple or compound, short, leafy at base, finely pubescent, comparatively few-flowered. Bracts leafy, ovate, those at base of raceme equal or longer than calyx, reduced above, acuminate. Pedicels very short, about 1 mm. long in fruit. Calyx finely pubescent, gland-tipped hairs abundant, subcylindric, 8–9.5 mm. long, the lobes slender, acuminate, subequaling tube, inflated at maturity. Corolla about 3 cm. long, sparsely pubescent. Nutlets 2.3 mm. long, sharply angled.

TEXAS: Val Verde County, along stream near the International Bridge at Del Rio, June 26, 1946, *D. S. Correll & H. B. Correll 12890* (type in the Lundell Herbarium), flowers lavender, spotted with purple.

In its large corolla, sharply toothed leaves, and calyx with stipitate glands, *D. Correllii* approaches *D. virginianum* L. It differs notably from that species in its large thin elliptic leaves, and stems conspicuously leafy to the base of the small inflorescence.

ADDITIONS TO THE ORCHIDS OF TEXAS[1]

DONOVAN S. CORRELL[2]

During the summer of 1946 I spent several months collecting throughout Texas under the auspices of Southern Methodist University. Although Pteridophytes were the main group of plants being sought, orchids were by no means neglected. The comparative rarity in Texas of the members of this plant family, except for ubiquitous species of *Spiranthes*, was soon realized. Notwithstanding, my wife, Dr. Helen B. Correll, who assisted me during June and part of July, and I found two species new to the flora of Texas as well as some further distribution records of other species already written up in the *Flora of Texas*. An examination of specimens which have become available to me since the publication of the orchids in the *Flora of Texas* reveals another species new to the State, two species new not only to Texas but also to the United States, as well as a new endemic species. The following paper is concerned with these additional species and supplementary distributional records for some of the orchids previously reported.

CYPRIPEDIUM CALCEOLUS L. var. PUBESCENS (Willd.) Correll, Bot. Mus. Leafl. Harv. Univ. 7: 14. 1938; Correll in Lundell, Flora of Texas 3, 3: 155, *pl. 1*. 1944.

Bailey Co., near Muleshoe, June 12, 1929 [depression northwest of town] *B. C. Tharp s.n.* Harrison Co., wooded ravine, Caddo Lake State Park, July 14, 1946, *D. S. Correll 13228*.

The occurrence of this plant on the Staked Plains (Bailey County) of western Texas is of interest but not unusual since it is also found in neighboring New Mexico (Colfax, Otero, San Miguel and Socorro counties). This station does, however, extend the variety's area of distribution in Texas from the Timber Belt region of eastern Texas, where it was thought to be confined.

× HABENARIA CHAPMANII (Small) Ames, Orch., fasc. 4: 155. 1910; Correll in Lundell, Flora of Texas 3, 3: 158. 1944.

Tyler Co., July 22, 1939, *B. C. Tharp s. n.*

[1] The Texan specimens of ORCHIDACEAE cited are deposited in the following herbaria: Oakes Ames Orchid Herbarium, Botanical Museum of Harvard University, Cambridge; University of Texas, Austin; S. M. Tracy Herbarium, Texas Agricultural Experiment Station, College Station; Herbarium of Southern Methodist University, Dallas; and Lundell Herbarium, Dallas.

Plates for the ORCHIDACEAE, copyrighted by Professor Oakes Ames of the Botanical Museum of Harvard University, are included with his permission. The excellent illustrations are the work of Blanche Ames (Mrs. Oakes Ames) and Gordon W. Dillon.

[2] This work is a part of that undertaken as a Fellow of the Guggenheim Memorial Foundation, 1946–47.

HABENARIA CLAVELLATA (Michx.) Spreng., Syst. Veg. 3: 689. 1826; Correll in Lundell, Flora of Texas 3, 3: 159, *pl. 3.* 1944.

Cass Co., 7 miles east of Hughes Springs, November 1, 1946, *Eula Whitehouse 17694.* Harrison Co., boggy woods, Caddo Lake State Park, July 14, 1946, *D. S. Correll 13225.* Tyler Co., boggy woods, Angelina National Forest, east of Rockland, July 17, 1946, *Correll 13305.*

HABENARIA CRISTATA (Michx.) R. Br. in Ait., Hort. Kew., ed. 2,5: 194. 1813; Correll in Lundell, Flora of Texas 3,3: 160, *pl. 4.* 1944.

Jasper Co., seepage slope in forest, Magnolia Springs, July 18, 1946, *D. S. Correll 13323.* Nacogdoches Co., in deep woods, south of Nacogdoches, September 24, 1938, *Eula Whitehouse 11179.* Shelby Co., Mangum Lake, July 22, 1940, *H. B. Parks, Jr. RX 1803.* Tyler Co., boggy meadow along stream bank, Angelina National Forest, east of Rockland, July 17, 1946, *Correll 13296.*

HABENARIA FLAVA (L.) R. Br. in Spreng., Syst. Veg. 3: 691. 1826; Correll in Lundell, Flora of Texas 3, 3: 161, *pl. 5.* 1944.

Harrison Co., rich moist hardwoods along a small stream, 3 miles west of Harleton, July 13, 1946, *D. S. Correll 13199.*

HABENARIA LACERA (Michx.) Lodd., Bot. Cab. 3: *pl. 229.* 1818. Fig. 6.

Orchis lacera Michx., Fl. Bor.-Am. 2: 156. 1803.
Platanthera psychodes Lindl., Gen. & Sp. Orch. Pl. 294. 1835, exclude synonym *Orchis psycodes.*
Platanthera laçera (Michx.) D. Don in Sweet, Hort. Brit., ed. 3: 650. 1839.
Fimbriella lacera (Michx.) Farwell, Eleventh Ann. Rpt. Commissioners Parks and Boulevards Detroit 55. 1900.
Blephariglottis lacera (Michx.) Farwell, Second Rpt. Mich. Acad. Sci. 42 (October 10, 1901); Rydberg in Britton, Man. Fl. North. States and Can., ed. 1: 296 (October 24, 1901).

Plant glabrous, rather stout, 2.5–7.5 dm. tall (often propagating by means of root-shoots). Roots slender, fleshy, from thickened tuberoids. Stem somewhat ribbed, leafy below, bracted above. Leaves rather rigid, erect, oblong-linear to oblong-obovate or linear-lanceolate, with the basal part sheathing the stem, 7–21 cm. long, 1.5–5 cm. wide. Raceme loosely or densely flowered, 3–26 cm. long, 3–4.5 cm. in diameter; floral bracts usually equaling the pedicellate ovaries, rarely exceeding the flowers, narrowly lanceolate to linear-lanceolate, acuminate, 1–4 cm. long. Flowers pale yellowish green or whitish green, with rather stout curving pedicellate ovaries which are 1.5–2 cm. long; dorsal sepal ovate to elliptic, concave, 4–5 mm. long, 3–4 mm. wide; lateral sepals obliquely ovate, obtuse, 4–6 mm. long, about 3 mm. wide; petals linear-oblong to narrowly oblong-spatulate, entire or rarely toothed at the truncate or rounded apex, rarely retuse, slightly oblique, 5–7 mm. long, mostly less than 2 mm. wide; lip deeply tripartite, 10–16 mm. long, 13–17 mm. wide across the lateral lobes; lateral lobes deeply cut (usually to the base) into three divisions, with the divisions subdivided again; mid-lobe slender, clavate to narrowly cuneate

Fig. 6. *Habenaria lacera* (Michx.) Lodd.: 1, plant, × ½; 2, flower, side view, × 2; 3, petal, × 2; 4, dorsal sepal, × 2; 5, lip, from above, × 2. × *Habenaria Andreswii* White: 6 & 7, flowers, front view, × 2. (a hybrid plant found in the northeastern states.) Drawn by Gordon W. Dillon.

or linear-spatulate, somewhat spreading above into irregular slender or coarse fringes, rarely erose to short-fringed at the apex, often laciniate halfway or more to the base; spur curved, slender or clavellate, as long as or longer than the pedicellate ovary, 1–2.3 cm. long. Capsule ellipsoid, erect, about 1.5 cm. long.—In open sedge swamps and marshes, bogs, meadows and glades of open woods, swampy woods, thickets and wet or dry open fields and prairies, blooming from May to August, in the Timber Belt of eastern Texas.

Bowie Co., moist woods, south of Dalby Springs, June 5, 1946, *D. S. Correll & H. B. Correll 12432.*

Vernacular names: "ragged fringed-orchis," "ragged-orchis," "green fringed-orchis."

Habenaria lacera is easily distinguished from all other Habenarias found in Texas. Only two other Texas species, *H. quinqueseta* (Michx.) Sw. and *H. repens* Nutt., have lips which are three-lobed. These, however, have the lobes entire, whereas the lobes of *H. lacera* are deeply fringed and lacerated. The finding of this species in Texas extends its known area of distribution considerably since the nearest previously known stations for it were in Arkansas (Drew and Pope counties), about two hundred miles north and east. The station in Texas probably represents the species most southwesterly point of migration.

This species is found on Miquelon Island, in Newfoundland, Nova Scotia, Prince Edward Island, New Brunswick and Ontario, through New England and the Atlantic States, south to Georgia, west to east Texas (none seen from Louisiana), Arkansas, Missouri, Illinois, Wisconsin, Minnesota and (?) Alberta.

HABENARIA NIVEA (Nutt.) Spreng., Syst. Veg. 3: 689. 1826; Correll in Lundell, Flora of Texas 3, 3: 162, *pl. 3.* 1944.

Hardin Co., near Sour Lake, off Sour Lake-Beaumont Road, in marsh in pineland, July 19, 1945, *C. L. Lundell & Amelia A. Lundell 14123.* Jasper Co., savannah, 2 miles south of Buna, June 9, 1946, *D. S. Correll & H. B. Correll 12534.*

HABENARIA REPENS Nutt., Gen. N. Am. Pl. 2: 190. 1818; Correll in Lundell, Flora of Texas 3, 3: 164. *pl. 8.* 1944.

Gonzales Co., growing in water, marsh near Ottine, Palmetto State Park, October 15, 1938, *Eula Whitehouse 11178;* Ottine, August 7, 1936, *B. C. Tharp s. n.* Wood Co., aquatic herb, Lake Ellis, 5 miles northeast of Crow, September 2, 1942, *C. L. Lundell & Amelia A. Lundell 11722.*

EPIPACTIS GIGANTEA Dougl. ex. Hook., Fl. Bor.-Am. 2: 202, *pl. 202.* 1839; Correll in Lundell, Flora of Texas 3, 3: 184, *pl. 25.* 1944.

Kendall Co., May 4, 1947, *G. L. Webster, C. M. Rowell & F. A. Barkley 17T178.* Presidio Co., abundant on seeping shaded banks, Mexican Canyon, tributary of Fresno Canyon, June 21, 1945, *C. H. Muller 8126.* County undetermined, Pedernales River, May 5, 1923, *B. C. Tharp s. n.*

PONTHIEVA RACEMOSA (Walt.) Mohr, Contr. U. S. Nat. Herb. 6 (Pl. Life Ala.): 460. 1901; Blake, Rhodora 17: 136. 1915. Fig. 7.

Arethusa racemosa Walt., Fl. Carol. 222. 1788.
Neottia glandulosa Sims, Bot. Mag. *pl. 842*. 1805.
Ponthieva glandulosa (Sims) R. Br. in Ait., Hort. Kew., ed. 2, 5: 200. 1813.
Ponthieva Brittonae Ames, Torreya 10: 90. 1910.

Plant erect, scapose, glandular-pubescent throughout (except the leaves), 1.3–6 dm. tall. Roots thick, fleshy, fasciculate, often lanuginose. Stem reddish brown, purplish or greenish. Leaves mostly in a basal rosette, oblong-elliptic to obovate or oblanceolate, obtuse to subacute, subsessile to long-petioled, 2–17 cm. long (including the wide petiole), 1–5.5 cm. wide, glaucous beneath, succulent when fresh, thin and papery when dry, reduced above to sheathing bracts. Raceme lax, consisting of wide-spreading flowers, 5–24 cm. long, 1.5–5 cm. in diameter; floral bracts ovate-lanceolate to narrowly lanceolate, acuminate-attenuate, 5–9 mm. long. Flowers white-green, fragrant, with rather stout ascending pedicellate ovaries which are 1–2.2 cm. long; dorsal sepal oblong-elliptic to broadly elliptic-lanceolate, obtuse to subacute, 3.8–8.5 mm. long, 2–3 mm. wide; lateral sepals broadly and obliquely ovate to ovate-oblong, obtuse to acute, 4.3–8 mm. long, 2.5–4 mm. wide; petals with a slender claw, obliquely triangular to semi-cordate, incurved, dilated on the outer margin at the base, constricted near the apex, obtuse to subacute, mostly ciliate, 4–8 mm. long, 1.5–5 mm. wide at the widest point; claw adnate to the column for about 1 mm. above the base; lip uppermost, with a short claw, suborbicular, concave-saccate with the lateral margins upturned, terminated by a linear obtuse to acute apical lobe, with an obscure linear median crest on the disc, 4–7.5 mm. long, 2.5–6 mm. wide when spread out; claw 1–2 mm. long; column curved, 2–4.5 mm. long. Capsule ellipsoid, 8–13 mm. long, about 5 mm. in diameter.—Usually in the vicinity of limestone or in calcareous soil in hammocks, woods along streams or on the rim of eroded stream banks in wooded ravines and on the edge of muddy sloughs and ponds, blooming from September to April, in the Timber Belt area of eastern Texas.

Jasper Co., in muddy soil along wooded stream, 4 miles south of Jasper, July 18, 1946, *D. S. Correll 13317*. Liberty Co., ravine bank, "Devil's Slide," east edge of Dayton, July 20, 1946, *Correll 13370*.

Vernacular names: "shadow-witch," "many-flowered Ponthieva," "glandulous Neottia," "glandular Ponthieva."

Previously, the nearest known station to Texas of this species was in Natchitoches Parish, in north-central Louisiana. It apparently occurs quite frequently in the Timber Belt area and should be looked for especially on the rim of old established eroded banks along wooded streams.

This species is found from southeastern Virginia on the Atlantic coastal plain to Florida, west to eastern Texas; also Mexico, Central America, Bahama Islands, the West Indies and South America.

ISOTRIA VERTICILLATA (Muhl. ex Willd.) Raf., Med. Repos. N. Y., Hex. 2,5: 357. 1808; Correll in Lundell, Flora of Texas 3,3: 168, *pls. 12 & 13*. 1944.

Fig. 7. *Ponthieva racemosa* (Walt.) Mohr: plant, × ⅔; 1, dorsal sepal, × 2; 2, flower, partly spread out, × 2; 3, lateral sepal, × 2; 4, lip, spread open, × 2; 5, column (a- anther, s- stigma), side view, × 8. Drawn by Blanche Ames.

Nacogdoches Co., along shaded bank of brook, 3 miles south of Nacogdoches, March 26, 1944, *C. L. Lundell & Amelia A. Lundell 12733;* along shaded bank of brook, 3 miles south of Nacogdoches, October 3, 1946, *Lundell & Lundell 14658;* in boggy area in deep woods, north of Nacogdoches, on highway 26, April 23, 1940, *Eula Whitehouse 11177.*

SPIRANTHES CERNUA (L.) L. C. Rich., Mém. Mus. Hist. Nat. Par. 4: 59. 1818; Correll in Lundell, Flora of Texas 3,3: 171, *pl. 15.* 1944.

Spiranthes montana Raf., Herb. Raf. 45. 1833; Fernald, Rhodora 48: 5. 1946, exclude synonymy.

Brazoria Co., lower Brazos River, October 21, 1939, *B. H. Warnock 20637.* Brazos Co., Little's Bee Yard, Jone's Bridge, Brazos River, October 20, 1945 and November 2, 1945 (peloric), *H. B. Parks s. n.* Cass Co., 7 miles east of Hughes Springs, November 1, 1946, *Eula Whitehouse 17681.* Cooke Co., prairie, near Tyler Bluff, western edge of county, July 2, 1946, *D. S. Correll & H. B. Correll 12941.* Hardin Co., in moist soil in pine woods, 2½ miles northwest of Saratoga, November 13, 1945, *V. L. Cory 50785.* Kaufman Co., 3¼ airline miles south by east of Combine, October 28, 1946, *V. L. Cory 52563.* Robertson Co., widespread on bog near Newbaden, October 30, 1943, *B. C. Tharp & Fred A. Barkley 13733.* Travis Co., Austin, *B. C. Tharp 1261.* Walker Co., infrequent in deep pines, sandy soil, 4 miles south of Huntsville, October 30, 1945, *C. C. Albers & B. H. Warnock 45–143.*

My colleague, Charles Schweinfurth, and I have studied Rafinesque's description of *S. montana* and have concluded that the plant which Rafinesque described, but not now extant in any herbarium, is referable to *S. cernua.* Rafinesque's description of the vegetative parts not only agrees with plants of *S. ovalis* which I have collected, but also agrees equally well with many of the specimens of *S. cernua* which we both have studied and collected. Rafinesque's description of the flowers as "mediocris" is a relative term and cannot be accepted with finality as meaning the smaller-flowered *S. ovalis.* The deciding point in our opinion, and the one on which we are forced to rely, is Rafinesque's description of the lip as being oblong, the characteristic shape of that organ in *S. cernua.* On the other hand, all of the flowers of *S. ovalis* which we have examined have the distinctive ovate type of lip, with a slight constriction about the middle. Typical illustrations of both species with a detailed drawing of the lip of each is shown in Plate 15 of the orchids in the *Flora of Texas.*

SPIRANTHES GRACILIS (Bigel.) Beck, Bot. North. & Middle States, ed. 1, 343. 1833; Correll in Lundell, Flora of Texas 3,3: 175, *pl. 18.* 1944.

Brazos Co., Little's Bee Yard, Jone's Bridge, Brazos River, November 2, 1945, *H. B. Parks s. n.* Denton Co., wooded slope near small stream, rare, 4½ miles north of Grapevine at "Cheatum Oaks," October 14, 1946, *Eula Whitehouse 17361.* Jasper Co., along stream, about 3 miles north of Bessmay, June 9, 1946, *D. S. Correll & H. B. Correll 12531.* Newton Co., moist soil near large rocks, about 5 miles north of Mayflower, June 11, 1946, *Correll & Correll 12608.*

SPIRANTHES GRAYI Ames, Rhodora 6: 44. 1904; Correll in Lundell, Flora of Texas 3, 3: 171, *pl. 14.* 1944 (as *Spiranthes Beckii* Lindl.).

Spiranthes simplex A. Gray, Man. Bot. North. U. S., ed. 5: 506. 1867, not Grisebach (1864).
Spiranthes tuberosa Raf. var. *Grayi* (Ames) Fernald, Rhodora 48: 189. 1946.

Brazos Co., Welborn, July 4, 1946, *H. B. Parks s. n.* Cherokee Co., dry woods, Love's Lookout State Park, July 16, 1946, *D. S. Correll 13256.* Gregg Co., July 24, 1939, *C. L. York s. n.* Harrison Co., open dry wooded slope, Caddo Lake State Park, July 14, 1946, *Correll 13207.* Jasper Co., sandy soil, about 3 miles north of Jasper, June 8, 1946, *D. S. Correll & H. B. Correll 12507.*

After much deliberation and weighing of the evidence, I have concluded that the most acceptable name for this much bandied about orchid is *S. Grayi* Ames. This name is not only appropriate, being in honor of Asa Gray, but it is based upon extant material which was the basis for Gray's correctly and adequately described *S. simplex*. The name *S. Grayi* replaced *S. simplex* A. Gray since that name was preëmpted by *S. simplex* Grisebach.

As Fernald amply pointed out recently (Rhodora 48: 189–192. 1946), the name *S. Beckii* Lindl. was born in confusion, not only as to the description but also as to the synonyms cited by Lindley. It seems best to me to consider the name *S. Beckii* Lindl. to be in the status of *nomen confusum*. Recently Fernald (Rhodora 48: 6 & 10. 1946) adopted the name *S. tuberosa* Raf. for the plant in question. The only character occurring in Rafinesque's description of *S. tuberosa* which can be interpreted as being descriptive of *S. Grayi* is that his plant possessed a solitary tuberous root. It is not uncommon for collectors to fail to obtain more than one of the fasciculate tuberous roots of *S. gracilis* when that species occurs in rocky or hard soil. Rafinesque described the lip of his plant as being cuneate and acute –a condition I have never observed in *S. Grayi*. It seems to me that to reject the thoroughly sound epithet *S. Grayi* Ames for the dubious *S. tuberosa* Raf. is not in the best interests of science. I am therefore considering the name *S. tuberosa* Raf. as being in the category *nomen dubium*.

SPIRANTHES LONGILABRIS Lindl., Gen. & Sp. Orch. Pl. 467. 1840. Correll in Lundell, Flora of Texas 3,3: 196. 1944. Fig. 8.

Spiranthes brevifolia Chapm., Fl. South. U. S., ed. 1: 462. 1860.
Gyrostachys brevifolia (Chapm.) O. Kuntze, Rev. Gen. Pl., pt. 2: 664. 1891.
Ibidium longilabris (Lindl.) House, Muhl. 1: 128. 1906.
Triorchis longilabris (Lindl.) House, Amer. Midl. Nat. 6: 206. 1920.

Plant erect, slender, flexuous, essentially glabrous throughout, occasionally pubescent above, 1.2–6 dm. tall. Roots fleshy, numerous, fasciculate. Leaves (when present) basal, linear to narrowly lanceolate, acute, 3–10 cm. long, mostly less than 5 mm. wide, reduced above to sheathing bracts. Spike slender, secund, only slightly spiraled at most, 5–14 cm. long; floral bracts broadly ovate to ovate-lanceolate, acuminate-elongate, 5–12 mm. long. Flowers white or white tinged with cream-color, conspicuously ringent, tubular, projecting almost horizontally away from the rachis; sepals 6–10 mm. long, 2–3 mm. wide; dorsal sepal oblong-elliptic to oblong-lanceolate,

Fig. 8. *Spiranthes longilabris* Lindl.: 1, plant, × ½; 2, flower, side view, × 3; 3, lip, spread out, × 3. *Spiranthes tortilis* (Sw.) L. C. Rich.: 4, plant × ½; 5, flower, side view, × 5; 6, lip, spread out, × 5. (a species found in Florida and Louisiana.) Drawn by Gordon W. Dillon.

subacute to acute; lateral sepals linear-lanceolate, spreading and recurved upward; petals linear, obtuse to subacute, 6.5–9.5 mm. long, about 1 mm. wide; lip yellow-white, narrowly ovate to ovate-oblong, from a broadened base, tapering to the obtuse to subacute apex, strongly arcuate-recurved, usually somewhat dentate or crenate along the apical margin, 6–10 mm. long, 3–5.5 mm. wide near the base; callosities rather slender; column about 4 mm. long.—Commonly found in wet grassy pine barrens and flatwoods, swamps, marshes, wet savannahs and prairies, sandy bogs and moist grassy meadows, occasionally in hammocks, dry shady oak woods and in low fields, blooming from October to December, in the Timber Belt of eastern Texas and in the Blackland Prairie area in Central Texas.

Newton Co., infrequent in pine woods, State Forest No. 1, 5 miles east of Kirbyville, November 17, 1945, *V. L. Cory 50932*. Travis Co., Austin, October 20, 1926, *B. C. Tharp s. n.*

Vernacular name: "giant spiral-orchid."

The characteristically secund inflorescence of horizontally projecting flowers separates this species from all other Texas *Spiranthes*. Its nearest ally, *S. praecox* (Walt.) S. Wats., with which it may be confused, has flowers whose lips are marked or veined with green, a character lacking in *S. longilabris*. The occurrence of this species in Texas extends its area of distribution from eastern Louisiana (Livingston, Orleans, St. Helena and St. Tammany parishes), a distance of more than two hundred miles.

This species is widespread in Florida but occurs sparingly along the Atlantic seaboard to eastern North Carolina and along the Gulf Coast to eastern Texas.

SPIRANTHES OVALIS Lindl., Gen. & Sp. Orch. Pl. 466. 1840; Correll in Lundell, Flora of Texas 3,3: 178, *pl. 15*. 1944.

Brazos Co., Ferguson's Crossing on Navasota River, October 3, 1945, *H. B. Parks s. n.*

SPIRANTHES PARKSII Correll, Am. Orch. Soc. Bull. 16:400, *pl.* 1947. Fig. 9.

Plant erect, 2–3.3 dm. tall. Roots fasciculate, fleshy. Stem slender, glabrous below, glandular-pubescent above, provided with several tubular acuminate sheaths. Leaves basal, absent at time of flowering. Spike short, few-flowered, glandular-pubescent, up to 5 cm. long and 1 cm. in diameter; floral bracts ovate-lanceolate, acuminate, concave, 8–10 mm. long. Flowers in a single spiral rank, ascending; sepals pubescent on the outer surface, 3-nerved; dorsal sepal ovate-elliptic to broadly ovate-lanceolate, abruptly recurved at the acute-apiculate apex, deeply concave, about 6 mm. long and 2.8 mm. wide below the middle; lateral sepals narrowly triangular-lanceolate, acuminate, oblique, with involute margins, about 7 mm. long and 2–2.5 mm. wide below the middle; petals adherent to the dorsal sepal, oval to obovate or suborbicular, rounded and sometimes irregularly notched at the apex, with the anterior margin more or less erose, 5-nerved, scarcely oblique, about 5 mm. long and 2.5–3 mm. wide; lip oval, broadly

Fig. 9. *Spiranthes Parksii* Correll: 1, plant, natural size; 2, flower, side view, × 4; 3, dorsal sepal, × 4; 4, petal, × 4; 5, lateral sepal, × 4; 6, lip, spread out, × 4. Drawn by Gordon W. Dillon.

rounded or emarginate at the apex, minutely erose-laciniate on the upcurved margins, 5–5.5 mm. long, 3.8–4 mm. wide at about the middle; basal callosities stout, pubescent; column short, stout, about 3.5 mm. long. —Along the Navasota River, blooming in October.

Brazos Co., Democrat Bridge, Navasota River, October 19, 1945, *H. B. Parks s. n.*

This species, which belongs to the section Euspiranthes, has no close allies in our flora. The characteristically obovate petals and oval lip are distinctive and conveniently separate this species from all other species of *Spiranthes* found in Texas. The original collection cited above is the only one known for this species.

SPIRANTHES PRAECOX (Walt.) S. Wats. in A. Gray, Man., ed. 6, 503, as to synonymy. 1890; Correll in Lundell, Flora of Texas 3,3: 179, *pl. 21.* 1944.

Orange Co., on wet prairies, near Orange, May 11, 1934, *Eula Whitehouse 11175.* Polk Co., May 14, 1942, *B. C. Tharp s. n.*

SPIRANTHES VERNALIS Engelm. & Gray, Bost. Journ. Nat. Hist. 5: 236 (Plantae Lindheimerianae, p. 28). 1845; Correll in Lundell, Flora of Texas 3,3: 180, *pl. 22.* 1944.

Angelina Co., south of Lufkin, April 28, 1942, *Eula Whitehouse 11174.* Brazoria Co., Angleton, May 8, 1945, *J. S. Williams 21.* Delta Co., roadside ditch, 3 miles southwest of Cooper, June 3, 1946, *D. S. Correll & H. B. Correll 12345.* Fannin Co., in fine sandy loam, border of scrub oak woods, 4 miles north of Bonham, June 10, 1945, *Lloyd H. Shinners 7839.* Galveston Co., May 5, 1942, *Mrs. A. F. Nelson s. n.* Red River Co., moist pasture, about 4 miles southeast of Manchester, June 4, 1946, *Correll & Correll 12377.* Van Zandt Co., in virgin prairie, east of Wills Point, off U. S. highway 80, June 26, 1945, *C. L. Lundell & Amelia A. Lundell 13944.*

CALOPOGON PULCHELLUS (Salisb.) R. Br. in Ait., Hort. Kew., ed. 2, 5: 204. 1813; Correll in Lundell, Flora of Texas 3,3: 186, *pl. 26.* 1944.

Angelina Co., upland bog, Angelina National Forest, Boykin Springs, June 10, 1946, *D. S. Correll & H. B. Correll 12567.* Jasper Co., savannah, 2 miles north of Kirbyville, June 9, 1946, *Correll & Correll 12508.* Jefferson Co., Beaumont, July 5, 1936, *Mrs. J. L. Hooks s. n.* Nacogdoches Co., in boggy soil, near Nacogdoches, April 23, 1940, *Eula Whitehouse 11173.* Polk Co., April 25, 1937, *B. C. Tharp s. n.* Robertson Co., near hummock in pitcher plant bog near Newbaden, June 16, 1943, *Fred A. Barkley 13020.*

CORALLORHIZA WISTERIANA Conrad, Journ. Acad. Nat. Sci. Phil. 6: 145. 1829; Correll in Lundell, Flora of Texas 3, 3: 189, *pl. 29.* 1944.

Brazos Co., College Station, February 16, 1937, *R. W. Strandtmann s. n.* Cherokee Co., Jacksonville, March 3, 1946, *P. A. Young s. n.* Hardin Co., near Kountze, April 23, 1940, *Eula Whitehouse 11181.* Harrison Co., April 7, 1947, *C. M. Rowell, C. L. York & B. C. Tharp 47227.* Travis Co., near oak tree in C. F. Gray's yard, Austin, March 6, 1946, *F. McAllister 4611*, Westfield, Austin, March 6, 1937, *J. Biesele s. n.*

The following correction should be noted. Since Chatelain, in establishing this genus, spelled the name with one "r," the epithet should be *Corallorhiza* and not *Corallorrhiza*.

EPIDENDRUM CONOPSEUM R. Br. in Ait., Hort. Kew. ed. 2, 5: 219. 1813; Correll in Lundell, Flora of Texas 3, 3: 196. 1944.

In the *Flora of Texas* I made the following comment: "It is very likely that with further exploration this epiphytic orchid will be found in some of the swamp-forests in southeastern Texas. I have collected this species near Lake Charles, Calcasieu Parish, Louisiana, where it was rather abundant high up in trees in a swamp. This station is only thirty miles from the Texas line."

In June and July we undertook to make a "further exploration" for this orchid in Orange and Jefferson counties in southeastern Texas. Although swamp-forests were explored along the Sabine and Neches rivers, Cow Bayou and other streams, no specimen of *E. conopseum* was taken. The prolific growth of the epiphytic fern, *Polypodium polypodioides* (L.) Watt and Spanish moss, *Tillandsia usneoides* L., very often proved to be a great hindrance in our looking for the orchid, not to mention the fiery stings and insidious annoyances of countless flies and mosquitoes which haunt the swamps of this part of the state. Notwithstanding our failure to find the orchid, there is little doubt in my mind that it will eventually be discovered in southeastern Texas. However, until that time, the species cannot be considered a part of the flora of Texas.

MALAXIS UNIFOLIA Michx., Fl. Bor.-Am. 2: 157. 1803: Correll in Lundell, Flora of Texas 3,3: 192, *pl. 32*. 1944.

Cherokee Co., along brook through pineland, between Wells and Alto, July 20, 1945, *C. L. Lundell & Amelia A. Lundell 14163*. Nacogdoches Co., Etiole, July 26, 1942, *H. B. Parks RX 1801*.

HEXALECTRIS GRANDIFLORA (A. Rich. & Gal.) L. O. Wms. in Johnston, Journ. Arn. Arb. 25: 81. 1944.

Corallorhiza grandiflora A. Rich. & Gal., Ann. Sci. Nat. Ser. 3, 3: 19. 1845.
Neottia grandiflora (A. Rich. & Gal.) O. Ktze., Rev. Gen. Pl. 2: 674. 1891.
Hexalectris mexicana Greenm., Proc. Am. Acad. 39: 77. 1903; Correll in Lundell, Flora of Texas 3,3; 194, *pl. 33*. 1944.

Williams, in his study of the ORCHIDACEAE of Mexico, concluded that the plant previously known as *H. mexicana* and reported as such in the *Flora of Texas* is now referable of *H. grandiflora*.

Since two additional species of *Hexalectris* are now added to the flora of Texas, the following key to all the species known to occur in the State is included for convenience in identifying them.

1. Mid-lobe of lip adorned with three irregularly scalloped and broken lamellae..... *H. Warnockii*.

1. Mid-lobe of lip not as above, without prominent lamellae..... 2.
2. Lateral lobes of lip free for 3 mm. or more..... 3.

3. Lateral lobes of lip oblong, obtuse; lip broadly elliptic in outline, 14 mm. or more long.....*H. revoluta.*

3. Lateral lobes of lip subquadrate to suborbicular-obovate, broad at the apex; lip obovate in outline, 13 mm. or less long.....*H. grandiflora.*

2. Lateral lobes of lip free for 2 mm. or less.....4.
4. Lip less than 10 mm. long.....*H. nitida.*
4. Lip more than 12 mm. long.....*H. spicata.*

HEXALECTRIS NITIDA L. O. Wms. in Johnston, Journ. Arn. Arb. 25: 81. 1944. Fig. 10.

Plant saprophytic, erect-ascending from a fleshy rhizome, up to 3.2 dm. tall. Stem rather stout, simple, aphyllous, provided with several short broad clasping apiculate bracts, apparently purplish in color. Raceme composed of about twenty flowers, short or elongated, up to 15 cm. long; floral bracts ovate-oblong, acute, about 5 mm. long. Flowers smallest in the genus, apparently deep purple in color and vernicose; dorsal sepal narrowly oblong-elliptic, obtuse, 8–11.5 mm. long, 3–4.5 mm. wide; lateral sepals obliquely elliptic, broadly rounded at the apex, 7–9 mm. long, 3–4 mm. wide; petals somewhat oblique, narrowly obovate to oblanceolate, broadly rounded at the apex, 8–10.5 mm. long, 3–3.5 mm. wide above the middle; lip obovate in outline, deeply 3-lobed above the middle, tapering on each side to the base, 7–9 mm. long, 4–6.5 mm. wide across the lateral lobes; lateral lobes semielliptic, broadly rounded at the apex, free for 1–1.5 mm.; midlobe suborbicular to suborbicular-cuneate, slightly retuse with a small apicule in the sinus at the apex, 2.5–3.5 mm. long, 2.5–3 mm. wide near the apex; lamina prominently nervose, with the five central nerves more or less lamellate; column arcuate, about 6 mm. long. Capsule ellipsoid, pendent, about 1.5 cm. long.—Among rocks in shaded canyons, blooming in August, found only in the Trans-Pecos area in western Texas.

Brewster Co., Panther Hill, Glass Mts., August 2, 1940, *B. H. Warnock W91.*

This species is not only new to Texas but also to the United States. It is the smallest flowered species in the genus.

Hexalectris nitida has been collected in the Sierra Mojada in the State of Coahuila, Mexico, the type locality.

HEXALECTRIS REVOLUTA Correll, Bot. Mus. Leafl. Harv. Univ. 10, No. 1: 18, *fig. 2.* 1941. Fig. 10.

Plant saprophytic, erect from a fleshy rhizome, 3–4.5 dm. tall. Stem stout, simple, aphyllous, provided with several short broad clasping bracts, apparently purplish in color. Raceme few-flowered, with as many as twelve flowers, up to 20 cm. long; floral bracts broadly ovate, acute, concave, 1–1.4 cm. long. Flowers with rather stout pedicellate ovaries which are about 1.5 cm. long; sepals and petals usually conspicuously revolute at the apex; dorsal sepal oblong-elliptic, bluntly obtuse, concave, 1.6–2.1 cm. long,

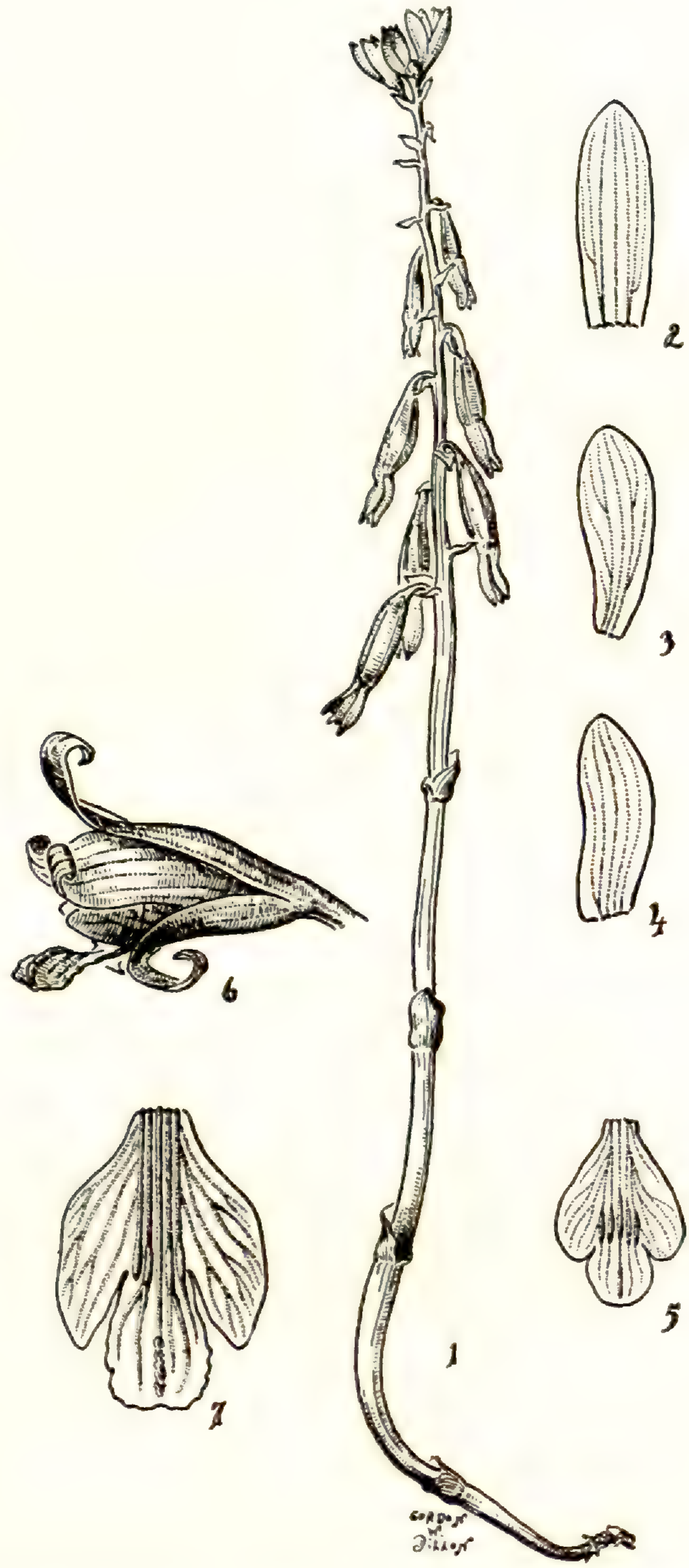

Fig. 10. *Hexalectris nitida* L. O. Wms.: 1, plant, × ⅔; 2, dorsal sepal, × 2; 3, petal, × 2; 4, lateral sepal, × 2; 5, lip, spread out, × 2. *Hexalectris revoluta* Correll: 6, flower, front-side view, in natural position, × 2; 7, lip, spread out, × 2. Drawn by Gordon W. Dillon.

3–7 mm. wide; lateral sepals oblique, elliptic to elliptic-lanceolate, obtuse to subacute or rarely minutely retuse at the apex, 1.5–2 cm. long, 3.5–7.5 mm. wide; petals oblique, elliptic to elliptic-obovate, bluntly obtuse, 1.5–1.9 cm. long, 4.5–7.5 mm. wide; lip broadly elliptic in outline, deeply 3-lobed, broadly cuneate at the base, 1.4–1.8 cm. long, 9–13 mm. wide across the lateral lobes; lateral lobes oblong, obtuse, with the free part 3–6 mm. long and 3.5–4.5 mm. wide; mid-lobe obovate-cuneate, truncate or retuse at the apex, upper margin undulate, with the central nerve prominently thickened above, 7–8.5 mm. long, 5–6 mm. wide across the apex; lamina prominently nervose, with all the nerves more or less raised and thickened, adorned with four or five somewhat equal lamellae at the base of the mid-lobe; column clavate, arcuate, about 1.5 cm. long. Capsule ellipsoid, pendent, about 2 cm. long.—In moist or dry open oak woods in canyons, blooming in June and July, found only in the Trans-Pecos area in western Texas.

Brewster Co., rare in lower willow creek basin of Chisos Mts., July 16, 1937, *B. H. Warnock 21551*.

This species is not only new to Texas but also to the United States. It is most closely related to *H. spicata*. The large plant bears comparatively few distant flowers. When the flowers are fully expanded in typical material the sepals and petals are conspicuously revolute, often being tightly rolled back a third or more of their length. As shown by the illustration, the lip is distinctly different in the shape and lobing from that of *H. spicata* (see *pl. 33, Flora of Texas*). Although the lamellation of the lip is somewhat similar in the two species, it is not so prominent in *H. revoluta*. Instead of five prominent keels at the base of the middle lobe as in *H. spicata*, the lip of *H. revoluta* has four or five keels which are only slightly raised.

This species is also found in Mexico where several collections have been made in the Sierra Madre Oriental in the State of Nuevo Leon.

HEXALECTRIS SPICATA (Walt.) Barnh., Torreya 4: 121. 1904; Correll in Lundell, Flora of Texas 3,3: 194, *pl. 33*. 1944.

Anderson Co., on rotten wood in forest, 3.5 miles east of Palestine, July 16, 1946, *D. S. Correll 13275*. Brazos Co., College Station, May 11, 1946, *H. B. Parks s. n.* Brewster Co., frequent in Maple Canyon, Glass Mts., June 18, 1941, *B. H. Warnock 21297*. Kendall Co., 8 miles north of Sisterdale, May 15, 1942, *H. B. Parks Px 010*. Palo Pinto Co., base of limestone ledges on forested slope, near Turkey Creek, 4 miles northwest of Mineral Wells, June 2, 1946. *D. S. Correll & H. B. Correll 12339*.

HEXALECTRIS WARNOCKII Ames & Correll, Bot. Mus. Leafl. Harv. Univ. 11: 8, *pl. 2*. 1943; Correll in Lundell, Flora of Texas 3,3: 195, *pl. 34*. 1944.

The following additional color notes may be added to the description of this species: plants maroon or deep purple, often becoming flesh-colored with age; raceme 3- to 8-flowered; sepals and petals maroon or deep purple; lip white with the lateral lobes veined with purple, adorned with orange-yellow lamellae and purple at the apex; capsule ellipsoid, pendent, about 1.5 cm. long.

Brewster Co., Love Peak Basin, Chisos Mts., July 20, 1932, *C. H. Mueller s. n.*; protected place in leaf mulch 6500 ft. up near Lost Mine Peak, Chisos Mts., June 18, 1937, *B. H. Warnock 20774;* rare in Upper Blue Creek Canyon, Chisos Mts., June 25, 1937, *Warnock 21261;* along trail to Baldy Peak, Chisos Mts., *Warnock 20776;* Basin, under oaks along canyon floor at window, Chisos Mts., August 4, 1946, *C. L. Lundell & Amelia A. Lundell 14609;* saprophyte in juniper-oak forest near "window" of Basin, Chisos Mts., August 4, 1946, *D. S. Correll 13630.* Gillespie Co., in oak-cedar grove, limestone soil, one mile north of Crabapple Creek on the road from Fredricksburg to Enchanted Rock, June 18, 1946, *D. S. Correll & H. B. Correll 12765.* Jeff Davis Co., sparse in Fern Canyon, 10 miles north of Alpine, August 22, 1939, *Warnock 21226.*

This species is probably rather widespread in Texas, but since it is difficult to see the maroon plant in its favorite habitat, shady cedar-oak groves, it is easily overlooked and consequently it remained unknown until fairly recently. If it were not for the excellent "field eyes" of my wife, its occurrence on the Edwards Plateau (Gillespie County) would still remain a secret.

It is of interest to note that a collection of this species from Arizona was recently sent to me by Dr. Walter S. Phillips, University of Arizona, for identification. It was collected by *Frank L. Fish* (#20) in the Chiricahua National Monument at the mouth of Rhyolite Canyon on August 29, 1939.

TWO ANOMALOUS NEW SPECIES OF ERIGERON L. FROM TEXAS[1]

LLOYD H. SHINNERS

Erigeron Geiseri Shinners, sp. nov. Planta annua e radice verticali. Caules unicae vel paucae 7–25 cm. altae erectae simplices vel cymose corymboseque ramosae, sat dense pilosae pilis 0.5–1.6 mm. longis. Folia inferiora spathulato-oblanceolata, basi petiolari lamen ellipticum vel oblongo-lanceolatum integrum parce dentatumve obtusum apiculatum fere aequante. Folia mediocria et inferiora 2–4 cm. longa (basi inclusa) 0.4–1.0 cm. lata. Folia superiora gradatim minora basique minus angustata. Pedunculi 0.6–4.5 cm. nudi. Capitula solitaria terminalia. Involucrum depresse hemisphaericum 3.0–3.7 mm. altum. Phyllaria biseriata aequalia lanceolata acuta ca. 1.1 mm. lata hispido-pubescentia pilis patentibus margine scariosa. Receptaculum obtuse conicum vel apiariiforme 2 mm. altum 2.0–2.5 mm. latum. Flores ligulati numerosi (65 ultra) biseriati ligulis brevibus anguste oblongis linearibusve ca. 3.6 mm. longis 0.5 mm. latis albidis rosaceis lavandulisve. Flores hermaphroditi tubulosi quinquedentati flavi ca 1.6 mm. longi. Achaenia compressa 2-nervata parce pubescentia 0.6 mm. longa. Pappus e setis 10 scabris aequalibus ca. 1.4 mm. longis et squamis 10 anguste oblongis hyalinis apice laceratis ca. 0.35 mm. longis constitutus.

Annual from a vertical taproot. Stems solitary or few, 7–25 cm. tall, erect, simple or cymosely and corymbosely branched from above or below the middle, moderately densely pilose with loosely appressed to widely spreading hairs 0.5–1.6 mm. long. Lower leaves spatulate-oblanceolate, the petiolar base about equalling the entire or sparingly dentate, elliptic to oblong-lanceolate, obtuse, apiculate blade. Middle and lower leaves 2–4 cm. long (including petiolar base), 0.4–1.0 cm. wide. Upper leaves gradually smaller and with less narrowed base. Peduncles naked for 0.6–4.5 cm. Heads solitary and terminal on the branchlets (peduncles). Involucre depressed-hemispheric, about 3.0–3.7 mm. high. Phyllaries in 2 rows, equal, lanceolate, acute, about 1.1 mm. wide, hispid-pubescent with widely spreading hairs, the margins scarious. Receptacle obtusely conical or beehive-shaped, about 2 mm. high, 2.0–2.5 mm. across. Rays numerous (over 65, one count), in two series; ligules short, narrowly oblong or linear, about 3.6 mm. long, 0.5 mm. wide, white to rosy or lavender. Disk corollas tubular, yellow, equally 5-toothed, about 1.6 mm. long (tube and limb not clearly differen-

[1] The specimens cited in this paper are deposited in the herbaria of the following institutions: Missouri Botanical Garden (Mo), Southern Methodist University (SMU), University of Texas (T), and Tracy Herbarium, Texas Agricultural and Mechanical College (TAM).

tiated; lobes 0.15 mm. long). Achenes compressed, 2-nerved, sparsely pubescent, yellowish, 0.6 mm. long. Pappus of 10 scabrous, equal bristles about 1.4 mm. long, and as many narrowly oblong, hyaline, lacerate-tipped scales about 0.35 mm. long.

The type was collected on a sandy and rocky roadside in Inks Lake State Park, west of Burnet, 3 miles south of Highway 29 entrance, Burnet Co., Texas, *Lloyd H. Shinners 7205*, April 17, 1945 (in herb. Southern Methodist University). The species is named in honor of Dr. S. W. Geiser, author of *Naturalists of the Frontier*, and well known for his historical studies of naturalists of the Southwest.

Although the genus *Erigeron* is usually described as having a flat receptacle, in some Texas species (for example, *E. tenuis* T. & G.) the receptacle at maturity is decidedly convex. The two new species here described both possess a conspicuously conical or beehive-shaped receptacle at maturity, but have the involucre, florets, and achenes of typical species of *Erigeron*. In its pappus, *E. Geiseri* shows close relationship to *E. coronarius* Greene (Pittonia 2: 167–168, 1891) of Chihuahua. A collection of this species from 8 miles north of Santo Tomas, Chihuahua, *C. H. Muller 3388*, also shows a conical receptacle like that of *E. Geiseri*, from which it differs in having much narrower linear leaves (those of the stem less than 2 mm. wide), widely and freely branching stems, numerous heads, and longer rays (about 6 mm. long). *Erigeron Geiseri* is apparently restricted to central Texas. The following collections may be cited:

Bastrop Co., 4 miles s.e. of Elgin, *Shinners 7251* (SMU). Falls Co., 9 miles s.e. of Marlin, *Shinners 7160* (SMU). Guadalupe Co., between Seguin and Lavernia, *Eula Whitehouse 10287* (SMU). Llano Co., Enchanted Rock, *Whitehouse 10291* (SMU). Robertson Co., 9 miles n.w. of Hearne, *Shinners 7154* (SMU).

ERIGERON GEISERI var. **calcicola** Shinners, var. nov. Caules longius hirsutae pilis articulatis 1.3–2.3 mm. longis patentibus; folia mediocria et inferiora plerumque apicem versus acute tamquam non profunde dentata. Pappus nullus nisi corona minuta squamosa vel subcartilaginosa minus quam 0.2 mm. longa. Caeterum ut in specie propria.

Stems with longer, rather shaggy, translucent, jointed hairs 1.3–2.3 mm. long, all widely spreading; middle and lower leaves mostly sharply though shallowly dentate in the apical third. Pappus of disk and ray florets a minute, denticulate, scaly or subcartilaginous crown less than 0.2 mm. long. Otherwise like the species.

The type and only known collection of this variety is from 19 miles north of Leakey, Real Co., Texas, *Shinners 7329*, April 20, 1945 (in herb. Southern Methodist University). The collection is noted as from "summit of Edwards Plateau; on limestone with very little soil. Abundant. Rays rosy to pink, short; disk deep yellow. Plants all infected by leaf fungus."

Erigeron mimegletes Shinners, sp. nov. Planta annua e radice verticali. Caules unicae vel paucae, 20–55 cm. altae hispido-pubescentes pilis fragilibus patentibus 1.1–2.5 mm. longis, laxe cymoso-paniculatae. Folia basalia

inferioraque basi angusta hispido-ciliata lamen oblanceolatum serratum crenatumve aequantia vel magis; lamina venosa utrinque hispido-pubescentia. Folia mediocria ca. 2 –3 cm. longa 0.3 0.7 mm. lata. Folia superiora integriora angustiora paulum breviora basique minus angustata, suprema anguste oblongo-oblanceolata, late acuta basique praecipue prominenter hispido-ciliata. Pedunculi 1–7 cm. nudi infra capitulum paulum incrassata cumque caule hispido-pubescentes. Capitula solitaria terminalia. Involucrum depresse hemisphaericum 3.0–3.5 mm. altum. Phyllaria biseriata aequalia anguste lineari-lanceolata acuta 0.5 mm. lata pilis late patentibus. Receptaculum conicum vel apiariiforme ca. 1.6 mm. altum 1.8 mm. latum. Flores ligulati numerosi biseriati ligulis brevissimis (etiam subnullis) anguste oblongis erectis albis ad 2.5 mm. longis (plerumque brevioribus) 0.5 mm. latis. Flores hermaphroditi tubulosi flavi quinquelobati ca. 1.9 mm. longi. Achaenia compressa 2- vel 4-costata parce pubescentia 1.3 mm. longa. Pappus nullus nisi corona obtusa albida cartilaginosa ei generis *Egletes* persimilis.

Plant annual from a vertical taproot. Stems single or few, 20–55 cm. tall, sparsely to densely hispid-pubescent with fragile, widely spreading hairs 1.1–2.5 mm. long, loosely cymose-paniculate from below or above the middle, sharply low-ridged by lines decurrent from the midribs of the leaves, yellow-green. Basal and lower stem leaves (usually absent from flowering specimens) with narrowed petiolar base equalling or exceeding the oblanceolate, serrate or crenate blade; blades veiny, hispid-pubescent on both sides. Middle stem leaves narrowly oblong or oblong-lanceolate, about 2–3 cm. long, 0.3–0.7 cm. wide. Upper leaves more entire, narrower, slightly shorter and with less narrowed base, the uppermost narrowly oblong-lanceolate. Peduncles naked for 1–7 cm., slightly thickened below the heads, hispid-pubescent with spreading hairs like those of the stem. Heads solitary and terminal on the branchlets (peduncles). Involucre depressed hemispheric, 3.0–3.5 mm. high, Phyllaries in 2 series, equal, narrowly linear-lanceolate, acute, 0.5 mm. wide, hispid with widely spreading hairs, with narrow yellowish or olive-brown midrib bordered on each side by a narrow dark green zone, the margins whitish, scarious. Receptacle rather sharply conical or beehive-shaped, about 1.6 mm. high, 1.8 mm. across. Rays numerous, in 2 series; ligules short, narrowly oblong, erect, white, up to 2.5 mm. long (usually shorter, sometimes not evident), 0.5 mm. wide; tube about 0.8 mm. long. Disk corollas yellow, equally 5-lobed, about 1.9 mm. long (tube and limb not clearly differentiated, lobes about 0.25 mm. long). Achenes compressed, 2- or 4-ribbed, sparsely pubescent, yellowish, 1.3 mm. long. Pappus apparently none, represented by a blunt, whitish, cartilaginous ring on the summit of the achene, like that characteristic of *Egletes*.

The type was collected in deer exclosure, J. M. Vander Stucken Ranch, 24 miles southeast of Sonora, Sutton Co., Texas, *V. L. Cory 53650*, May 4, 1947 (in herb. Southern Methodist University). According to the collector, the species is a good forage plant, but soon disappears under grazing. It is found in and near the southern part of the Edwards Plateau of Texas.

Erigeron mimegletes has generally been mistaken for an *Aphanostephus*, and some herbarium specimens bear an unpublished name in that genus by a previous monographer whose revision was never completed. Its compressed, ribbed achenes and its involucre, however, are those of *Erigeron*, and its general habit suggests *E. strigosus* Muhl. The cartilaginous crown which represents the pappus is strikingly like that of *Egletes*, but the plant otherwise bears little resemblance to members of that genus.

The following additional specimens have been seen:

Crockett Co., Ozona Cemetery, *B. C. Tharp*, July 9, 1928 (T). Edwards Co., D Exclosure, Substation No. 14, *Cory 37276* (T). Schleicher Co., Eldorado Cemetery, *Cory 39003* (T). Sutton Co., S. S. Bundy Ranch, *Cory 3876* (TAM). Val Verde Co., Del Rio, *E. J. Palmer 13582* (Mo).

REVISION OF THE GENUS KRIGIA SCHREBER[1]

LLOYD H. SHINNERS

INTRODUCTION

It is exceptional among the COMPOSITAE to find a genus of great taxonomic simplicity. *Krigia* is such a genus. So well-marked and distinct are its species that they are often placed in separate genera, even by conservative botanists. But differences in pappus, on which the segregate genera are chiefly based, are slight. Within the single species *Krigia occidentalis* Nutt. both single and double pappus may occur, and the normally epappose *K. oppositifolia* Raf. occasionally shows a minute scaly crown on the achene. In structure of florets, achenes, involucre, and foliage, there is such great similarity between the species variously classified under *Krigia*, *Cynthia*, *Cymbia*, and *Serinia*, that it seems preferable to treat them as a single unified and coherent genus.

SYSTEMATIC TREATMENT

KRIGIA Schreber, Gen. Pl. (ed. 8) 2: 532–533. 1791. Type species: *Krigia virginica* (L.) Willd., Sp. pl. (ed. 4) 3 pt. 3: 1618. 1803.

The name *Adopogon* Necker, Elementa Botanica 1: 55–56, 1790, was taken up for this genus by Kuntze, Rev. Gen. Pl. 1: 304, 1891. No species were listed by Necker, who described the genus as characterized by "pappo stipitato simplici." Since none of the species of *Krigia* has a stipitate pappus, and the majority (including the type species, *K. virginica*) have a double pappus, *Adopogon* Necker must be excluded from the synonymy of the genus. Accordingly the conservation of the name *Krigia* against *Adopogon* in the International Rules of Botanical Nomenclature (p. 111, 1935; Brittonia 6: 93, 1947) is not necessary. *Cynthia* sect. *Adopogon* (Necker) DC., Prodr. 7: 89, 1838, is also to be excluded from the proper synonymy of *Krigia*, although De Candolle

[1] The cited specimens are deposited in the herbaria of the following institutions: Gray Herbarium of Harvard University (G), University of Illinois (Ill), Milwaukee Public Museum (MM), Missouri Botanical Garden (Mo), New York Botanical Garden (NY), North Texas State College, Denton (NT), University of Pennsylvania (Pa), Southern Methodist University (SMU), Texas Agricultural and Mechanical College (TAM), University of Texas (T), United States National Herbarium (US), and West Virginia University (WV). Much more difficulty was occasioned by the bibliography than by the taxonomy of the plants themselves, and I have again to thank Miss Nell C. Horner, librarian of the Missouri Botanical Garden, and Miss Ruth D. Sanderson, librarian of the Gray Herbarium, for assistance with the numerous references. Particular acknowledgement is due Dr. Ivan Klášterský, head of the Botanical Department, National Museum, Prague, Czechoslovakia, who supplied a microfilm copy of the very rare *Sammlung physikalisch-ökonomischer Aufsätze, Aufnahme der Naturkunde und deren damit verwandten Wissenschaften in Böhmen*, edited by F. W. Schmidt, and published at Prague in 1795.

used this name only for *Krigia Dandelion* (L.) Nutt. (as *Cynthia Dandelion* (L.) DC.).

Troximon Gaertner, De Fructibus et Seminibus Plantarum 2: 360–361. 1790. Based on "Tragopogon *dandelion, virginicum* & *lanatum*. LINN."; i.e., *Krigia Dandelion* (L.) Nutt., *K. virginica* (L.) Willd., and *Scorzonera lanata* (L.) Bieb.

Serinia Raf., Fl. Ludov. p. 149. 1817. Type species: *S. cespitosa* Raf. (= *Krigia oppositifolia* Raf.).

Apogon Ell., Sk. Bot. S. C. & Ga. 2: 267. 1822? (dated 1824). Type species: *A. humilis* Ell. (= *Krigia oppositifolia* Raf.).

Cynthia D. Don, Edinb. New Philos. Journ. 6: 309. 1829. Type species: *C. virginica* (L.) D. Don ex DC (= *Krigia biflora* (Walt.) Blake).

Luthera Sch. Bip., Linnaea 10: 257. 1835. Substitute name for *Cynthia* D. Don, not Fabricius.

Laxanon Raf., New Fl. N. A. 2: 16. 1837 (dated 1836). Type species *L. parviflorum* Raf. (= *Krigia oppositifolia* Raf.).

Aptilon Raf., New Fl. N. A. 4: 106. 1838 (dated 1836). Substitute name for *Apogon* Ell.

Cymbia (T. & G.) Standley, Contr. U. S. Nat. Herb. 13: 354. 1911. Based on *Krigia* § *Cymbia* T. & G. Type species: *C. occidentalis* (Nutt.) Standl. (= *Krigia occidentalis* Nutt.).

Small, annual or perennial, caulescent or acaulescent herbs. Leaves basal, or alternate, or a few of the upper so closely approximated as to appear opposite; simple, entire or toothed to deeply pinnately or lyrately lobed; sessile or with narrowed petiole-like base. Heads solitary and terminal on the scapes or branchlets (peduncles), few- to many-flowered, homogamous, homochromous. Involucre of a single or double row of nearly equal phyllaries. Receptacle flat or slightly concave, becoming slightly convex in fruit, naked. Florets all perfect, ligulate. Anthers short-appendaged and short-tailed, the tails slender, much shorter than the anther tube, often appressed to the filament and very inconspicuous. Style branches very short, flattened, not appendaged. Achenes ovoid-columnar to prismatic, slightly narrowed at summit, but not beaked. Pappus none, or single, or double: when present, of few hyaline scales, or an inner ring of scabrous, unequal bristles (normally 5 or multiple of 5), and an outer ring of very short scales (usually about 5 or 10).

KEY TO THE SPECIES OF KRIGIA

1. Phyllaries 4–8 times as long as wide, linear-lanceolate to oblong-lanceolate, relatively numerous (8–16), becoming shrivelled and reflexed in age, never keeled, scarcely even with a definite midvein; inner pappus of bristles 4.5–8.0 mm. long, outer pappus of as many or fewer short scales less than ¼ as long (section *Eucynthia*).....2.

2. Involucres 7–15 mm. high, scarcely enlarged in fruit; plants perennial from a short caudex.....3.

3. Stems leafless and unbranched; plants with a small tuber a few centimeters underground, and producing slender rhizomes.... .....1. *K. Dandelion.*

3. Stems leafy (but leaves may be crowded near base when plant first flowers, or stem leaves may be reduced to leafy bracts), usually forked or several-branched; plants with short simple or branched caudex, but no tuber or rhizomes.....4.

4. Peduncles arising in the axil of an ordinary foliage leaf, single; ordinary unreduced leaves extending a short distance up the stem.....2. *K. montana.*

4. Peduncles arising in the axil of one or several short leafy bracts, single or several together; leaves nearly all basal, stem leaves few and reduced.....3. *K. biflora.*

2. Involucres 4.0–6.5 mm. high (up to 9 mm. in fruit); plants annual (sometimes reviving and flowering twice in one year, or rarely overwintering in the south, such plants usually completely leafless) .....4. *K.virginica.*

1. Phyllaries 1½–3 times as long as wide, lanceolate to ovate, remaining erect and expanded in age, relatively few (4–10), with midvein which in age becomes prominent and keel-like; pappus wanting, or of short scales, or of short bristles up to 2 mm. long and an equal number of hyaline scales ⅓ or more as long (section *Cymbia*).....5.

5. Stems leafless and unbranched (but robust or partly buried plants may develop short basal internodes); well developed pappus present, of scales or both scales and bristles .....5. *K occidentalis.*

5. Stems leafy, branched (but leaves may be crowded near the base in stunted plants); pappus absent, or merely a minute scaly crown .....6.

6. Involucres 3.0–4.3 mm. high in flower, 3.3–5.3 mm. high in fruit; ligules 2–4 mm. long.....6. *K. oppositifolia.*

6. Involucres 5.3–8.3 mm. high in flower, 6.2–8.5 mm. high in fruit; ligules 5–10 mm. long.....7. *K. gracilis.*

Section 1. EUCYNTHIA DC., Prodr. 7: 89. 1838 (As *Cynthia* sect. *Eucynthia.*) Type species: *Cynthia virginica* (L.) D. Don ex DC. (= *Krigia biflora* (Walt.) Blake.

Krigia § *Eukrigia* T. & G., Fl. N. A. 2: 468. 1843. Type species: *K. virginica* (L.) Willd. Referred to as "sectio *Eukrigia*" by Scheele, Linnae 25: 257. 1853.

Krigia § *Cynthia* (D. Don) A. Gray, Syn. Fl. N. A. 1 pt. 2: 412. 1884. Based on *Cynthia* D. Don.

Phyllaries becoming shrivelled and reflexed in age, the mid-vein not prominent, usually scarcely evident, never becoming keel-like. Pappus always double, the outer inconspicuous, of very short scales, much shorter and as many as or fewer in number than the numerous bristles which make up the inner.

1. KRIGIA DANDELION (L.) Nutt., Gen. 2: 127. 1818.

Leontodon Dandelion L., Sp. Pl. (ed. 1) 2: 798. 1753. Based on "*Leontodon foliis ensiformibus integris*, caule erecto simplici" Gronovius, Fl. Virg. (ed. 1) p. 90, 1739 (the second phrase quoted by Linnaeus as "calyce erecto simplici," so given in the second edition of Gronovius's Flora, 1762). This described from *Clayton 19* and *383* (not seen).

Tragopogon Dandelion (L.) L., Sp. Pl. (ed. 2) 2: 1111. 1762.

Hyoseris major Walt., Fl. Carol. p. 194. 1788. Type collected by Walter in South Carolina; not seen.

Troximon Dandelion (L.) F. W. Schmidt, Sammlung Physikalisch-ökonomisch Aufsätze 1: 268. 1795. This combination also published by Persoon, Syn. Pl. 2: 360. 1807. Based on *Leontodon Dandelion* L.

Hyoseris angustifolia Michx., Fl. Bor.-Am. 2: 87. 1803. "*HAB.* in Carolina." Type not seen.

Cynthia lyrata Nutt., Journ. Acad. Nat. Sci. Phila. 7: 68–69. 1834. "Collected by myself and Docor Pitcher, in the territory of Arkansas." Type not seen, but a specimen bearing this name in the herbarium of the Academy of Natural Sciences, Philadelphia, originally from the herbarium of Schweinitz, and marked "Elliott—S. Carol.," is *Krigia Dandelion* (L.) Nutt.

Cynthia Dandelion (L.) DC., Prodr. 7: 89. 1838. Based on *Leontodon Dandelion* L.

Cynthia Boscii DC., Prodr. 7: 89. 1838. "In Carolina (*Bosc!*)." Type not seen.

Adopogon Dandelion (L.) Kuntze, Rev. Gan. Pl. 1: 304. 1891. Based on *Leontodon Dandelion* L.

Stemless perennial from a crown, with numerous fibrous roots, and a false taproot (rhizome) bearing a globose or ovoid tuber 5–15 mm. in diameter at a depth of 0.5–6.0 cm.; and producing delicate, soft, white, thread-like, simple or branching rhizomes at or near the surface of the ground, extending from the crown of the old plant for a distance of half a meter or possibly more, terminating in a leafy sprout (new plant) at the surface, or more commonly a tuber (new plant of the succeeding year) a short distance below the surface. Scapes solitary or several, 10–45 cm. tall, erect, glabrous or with widely spreading, jointed, glandular-capitate hairs below the involucre. Leaves numerous, in a basal cluster, the earlier ones (soon withering) subsessile or with narrowed petiolar base 2.0–5.5 cm. long, and elliptic to oblanceolate, obtuse, entire or denticulate blades 3.5–6.0 cm. long by 0.8–2.0 cm. wide. Remaining leaves longer, petiolar base winged and less distinctly marked, the blades narrowly lanceolate or lanceolate-linear and acute, entire to deeply and laciniately pinnatifid with remote, uneven divisions; total length (including base) 8–22 cm., width 0.5– .0 cm. All leaves glaucous, glabrous or sparingly pubescent on both surfaces with appressed, inconspicuous, whitish hairs; and with prominent single or triple midrib and less prominent nearly parallel lateral veins extending nearly the whole length of the leaf. Heads solitary, with 25–34 florets. Involucres 10–15 mm.

high, scarcely enlarged in fruit; of 15 erect, equal phyllaries in two series, 1.6–2.3 mm. wide, separate nearly or quite to the base, oblong-linear or lanceolate-linear, acute, green (sometimes tipped or spotted red-purple), the inner scarious-margined, all glabrous or sparingly ciliate with glandular-capitate hairs, rarely with a few such hairs on the back near the base, reflexed and shrivelled in age. Receptacle flat or low-convex, naked, glabrous, roughened by the points of attachment of the achenes and by a few low projections from the surface. Corollas light orange or yellow-orange (ligules sometimes purplish on the back), open during the morning. Ligules narrowly oblong, 12–17 mm. long, 3.0–3.5 mm. wide, four-nerved, truncate and five-toothed at the apex; tube 2–4 mm. long, densely pubescent towards the summit with whitish, jointed, translucent hairs. Anther appendages oblong, about 0.4 mm. long; anther tails acuminate, about 0.5 mm. long, about $\frac{1}{8}$ as long as the tube. Style branches flattened, rhombic-lanceolate, about 0.4 mm. long; style long-exserted in full flower. Achenes columnar, 10- or 15-ribbed, appressed pubescent, about 2.5 mm. long, nearly 1 mm. thick, red-brown (few well developed mature achenes seen). Inner pappus of 25–45 unequal scabrous bristles 5–8 mm. long, the shortest as little as $\frac{1}{3}$ as long as the longest. Outer pappus of 10 inconspicuous, oblong-lanceolate, acute or acuminate, hyaline scales about 0.6–1.0 mm. long, with a dark central line or more or less distinct midrib toward the base, often split or lacerate at the tip.

Open ground or open woods, chiefly in sandy soil, Florida to Texas, Kansas (according to Small, Manual of the southeastern flora, p. 1490, 1934), and New Jersey. Reported from southern Indiana by Deam (Flora of Indiana p. 1005, 1940). Primarily a plant of the Coastal Plain, flowering in April and May.

Some specimens examined: ARKANSAS: Drew Co., Monticello, *Delzie Demaree 25364* (SMU). Pulaski Co., without locality, *Dr. H. E. Hasse*, May, 1886 (MM). Servier Co., Horatio, *Elizabeth Brinkley*, May 15, 1937 (T). Washington Co., Fayetteville, *F. L. Harvey Ark. Fl. 51* (Ill.) DISTRICT OF COLUMBIA: Sandy Landing, *Theo. Holm*, May 10, 1899 (Ill). ILLINOIS: Jefferson Co., Mt. Vernon, *Florence Wooden*, May 31, 1940 (Ill). Randolph Co., 16 miles s. of Columbia, *Bill Bauer 2325* (Ill.) Wabash Co., Mt. Carmel, *J. Schneck*, May 27, 1905 (Ill). KENTUCKY: McCracken Co., Paducah, *H. C. Benke 3734* (MM). LOUISIANA: Jeff Davis Parish, 3 miles e. of Welsh, *Reginald Rose-Innes & Barton H. Warnock 710* (T). MARYLAND: Montgomery Co., Great Falls, *Charles Williamson*, May 30, 1909 (Pa). MISSOURI: Iron Co., Arcadia, *Ward Sharp*, May 19, 1931 (WV). Maries Co.; Belle, *Benke 4211* (MM). NEW JERSEY: Cape May Co., Cold Spring, *W. Stone*, May 18, 1913 (Pa). NORTH CAROLINA: Durham Co., Durham, *H. L. Blomquist*, spring, 1928 (Pa). Halifax Co., Weldon, *Williamson*, April 10, 1908 (Pa). Rowan Co., without locality, *W. M. Davis*, May, 1882 (Pa). Wake Co., 1.5 miles n.w. of Cary, *J. M. Fogg, Jr. 5448* (Pa). OKLAHOMA: Leflore Co., near Page, *G. W. Stevens 1407* (Ill). Muskogee Co., "Muscogee, I. T.," *M. A. Carleton 62* (Ill). TENNESSEE: without locality, *William A. Nason*, April 26, 1855 (Ill). TEXAS: Anderson Co., Palestine, *Eula Whitehouse 11051* (SMU). Angelina Co., north of Lufkin, *C. L. Lundell & Amelia A. Lundell 11104* (SMU); Lufkin,

H. B. Parks & V. L. Cory 8055 (TAM). Austin Co., Industry, *Hugo Wurzlow*, 1891 (Ill); *B. C. Tharp*, April 10, 1936 (T). Brazoria Co., Alvin, *S. M. Tracy 9000* (Pa, T, TAM). Camp Co., 5 miles w. of Pittsburg, *L. H. Shinners 7512* (SMU). Chambers Co., without locality, *Tharp*, April 7–10, 1936 (NT, SMU, T, TAM). Dewitt Co., w. of Huisache, *collector not named*, May, 1939 (TAM). Ft. Bend Co., Richmond, *W. L. Bray 104* (T). Franklin Co., 3 miles e. of Mt. Vernon, *Shinners 7492* (SMU). Harris Co., Goose Creek, "*R. E. L. Hi-School*," spring, 1930 (T); w. of Houston, *W. T. Penfound*, April 10, 1936 (T). Harrison Co.: near Marshall, *Whitehouse 11053* (SMU). Hopkins Co., 7 miles e. of Sulphur Springs, *Shinners 7466* (SMU). Houston Co., Lovelady, *A. Freeman*, April 22, 1930 (T). Hunt Co., 8 miles e. of Greenville, *Shinners 7459* (SMU). Lamar Co., Paris, *E. McMullen*, March 18, 1927 (T). Jefferson Co., Hamshire, *Frederick Englin*, March 26, 1928 (T). Panola Co., 23 miles n.e. of Carthage, *Shinners 7592* (SMU). Parker Co., without locality, *B. B. Harris*, May 10, 1930 (NT). Rusk Co., Henderson, "*School*," spring, 1929 (T). San Jacinto Co., Cold Springs, *Whitehouse 11052* (SMU). Titus Co., 2 miles e. of Mt. Pleasant, *Shinners 7502* (SMU); Talco, *Marie Colley*, May, 1930 (T). Van Zandt Co., Wills Point, *J. B. Henderson*, April, 1929 (T); 2 miles e. of Wills Point, *Shinners 7538* (SMU). Washington Co., without locality, *Eunice Brackett*, April, 1939 (T). Wood Co., 7 miles s.w. of Winnsboro, *Shinners 7514* (SMU).

2. KRIGIA MONTANA (Michx.) Nutt., Gen. 2: 127. 1818.

Hyoseris montana Michx., Fl. Bor.-Am. 2: 87. 1803. "*HAB.* in altissimis montibus Carolinae septentrionalis." Phototype (Gray Herbarium): "Sommet des hautes mont. de la Carol. Sept.," *Michaux* (original in herb. Paris Museum).

Cynthia Dandelion var. *montana* Chapman, Fl. S. U. S. p. 250. 1860. "On the mountains of North Carolina." *Hyoseris montana* Michx. cited as synonym, with query.

Adopogon montanum (Michx.) Kuntze, Rev. Gan. Pl. 1: 304. 1891. Based on *Hyoseris montana* Michx.

Cynthia montana (Michx.) Standley, Contr. U. S. Nat. Herb. 13: 356. Based on *Hyoseris montana* Michx.

Spring or primary flowering form (late May-July, occasionally later): Perennial from a narrow, somewhat elongated, branched caudex or root-stock 3–6 mm. thick. Stems slender, few or many, glabrous or with a few long, slender, translucent hairs, ascending to erect, branched, 6–36 cm. long at flowering time. Heads solitary and terminal on long, single, naked peduncles 4–28 cm. long, the peduncles usually occupying ½ to ¾ of the entire plant. Leaves crowded near the base of the stem, oblong-lanceolate to very narrowly oblanceolate or lance-linear, the more slender ones often falcate or cirrhous, glabrous, entire or denticulate to deeply runcinate-pinnatifid with rather remote, irregular, acute divisions, narrowed and petiole-like toward base, but expanded at the attachment to the stem and more or less sheathing, the lowest 3–16 cm. long by 0.2–3.0 cm. wide. Involucres turbinate or campanulate, 8–10 mm. high, scarcely enlarged in fruit; of 8–12 glabrous, equal, uniseriate and laterally much overlapping or biseriate,

lanceolate or narrowly oblong-lanceolate, broadly acute phyllaries about 2–3 mm. wide, with dark base and very narrow scarious margins. Florets 23–29 (three counts), apparently yellow-orange when fresh, sometimes purplish-tinged on the back. Ligules narrowly oblong, truncate and deeply 5-toothed at the apex, 10–18 mm. long (teeth unequal, 1–2 mm. long); corolla tube cylindrical, about 3–5 mm. long, with coarse, jointed, translucent hairs at the summit, extending onto the underside of the base of the ligule. Anther appendages about 0.25 mm. long; anther tails about 0.4 mm. long, lance-linear, about $\frac{1}{6}$ as long as the tube. Style branches oblong-lanceolate, subacute, about 0.5 mm. long. Achenes about 2.2–2.6 mm. long, columnar, dark red-brown, spinulose-pubescent on the ribs. Pappus of 15–25 scabrous, whitish or yellowish, unequal bristles up to 4.5–6.0 mm. long, the shortest about $\frac{1}{2}$–$\frac{2}{3}$ as long as the longest; and 5 oblong-oval, erose, brown, hyaline scales 0.6–1.0 mm. long.

Late summer form (August-September): Lowest leaves withered; stems elongate and freely branching, the branches ascending or nearly erect, arising from the axils of the numerous, slender, mostly entire stem leaves. Whole plant bushy in appearance, up to 50 cm. tall. Naked peduncles occupying about $\frac{1}{4}$–$\frac{1}{2}$ the total height of the plant.

In damp crevices of granitic rocks, in ravines or on north slopes, in the mountains from western North Carolina and eastern Tennessee to northern Georgia. Apparently local and uncommon.

Some specimens examined: GEORGIA: Rabun Co., Tallulah Falls, *T. C. Porter*, summer, 1846 (G); *John K. Small*, Sept. 3–5, 1894 (Mo); "Tolula Falls," *S. B. Buckley* (G). NORTH CAROLINA: Buncombe Co., summit of Craggy Mountain, *Biltmore Herb. 4098b* (G, Mo). Henderson Co., Mt. Pisgah, *F. W. Hunnewell 9958* (G). Jackson Co., west of Cashiers, *E. T. Wherry & F. W. Pennell 14163* (Mo). Macon Co., near Highlands, *Biltmore Herb. 4098a* (G, Mo). SOUTH CAROLINA: Greenville Co., Ceasar's Head, *J. H. Redfield*, Sept. 2, 1876 (Pa), *John Donnell Smith*, Aug. 6, 1881 (G); falls of the Saluda River, *Smith*, Aug. 12, 1881 (G). TENNESSEE: Sevier Co., Mt. Le Conte, *William B. Fox*, Aug. 21, 1940 (WV).

3. KRIGIA BIFLORA (Walt.) Blake, Rhodora 17: 135. 1915.

Tragopogon virginicum L., Sp. Pl. (ed. 1) 2: 789–790. 1753. "*Habitat in* Virginia, Canada." Type not seen. Not *Krigia virginica* (L). Willd., 1803.

Hyoseris biflora Walt., Fl. Carol. p. 194. 1788. Type collected by Walter in South Carolina, not preserved (according to Blake, Rhodora 17: 135, 1915).

Troximon virginicum (L.) F. W. Schmidt, Sammlung physikalisch-ökonomisch Aufsätze 1: 268. 1795. This combination also published by Persoon, Syn. Pl. 2: 360. 1807. Based on *Tragopogon virginicum* L.

Hyoseris amplexicaulis Michx., Fl. Bor.-Am. 2: 87–88. 1803. "*HAB.* in Pennsylvania, Tennassee et Carolina." Type not seen. "*H. biflora*? WALT." cited as synonym.

Hyoseris prenanthoides Willd., Sp. Pl. (ed. 4) 3 pt. 3: 1615. 1803. Substitute name for *Tragopogon virginicum* L.

Krigia amplexicaulis (Michx.) Nutt., Gen. 2: 127. 1818. Based on *Hyoseris amplexicaulis* Michx.

Cynthia amplexicaulis (Michx.) Beck, Bot. No. & Middle States p. 168. 1833. Based on *Hyoseris amplexicaulis* Michx.

Cynthia Griffithii Nutt., Journ. Acad. Nat. Sci. Phila. 7: 69. 1834. "In the vicinity of Philadelphia"; *R. E. Griffith* (in herb. Acad. Nat. Sci. Phila.).

Luthera virginica (L.) Sch. Bip., Linnaea 10: 257. 1835. Based on *Tragopogon virginicum* L.

Krigia integrifolia Raf., New Fl. N. A. 4: 86–87. 1838 (dated 1836). "Mts., Alleghanies." Type not seen.

Cynthia virginica (L.) D. Don ex DC., Prodr. 7: 89. 1838. Based on *Tragopogon virginicum* L.

Adopogon amplexicaule (Michx.) Kuntze, Rev. Gen. Pl. 1: 304. 1891. Based on *Hyoseris amplexicaulis* Michx.

Adopogon virginicum (L.) Kuntze, Rev. Gen. Pl. 1: 304. 1891. Based on *Tragopogon virginicum* L.

Krigia virginica (L.) A. Nels., Coulter & Nelson New. Man. Rocky Mt. Bot. p. 589. 1909. Based on *Tragopogon virginicum* L. Not *Krigia virginica* (L.) Willd., 1803 (based on *Hyoseris virginica* L.).

Cynthia falcata Standley, Contr. U. S. Nat. Herb. 13: 356. 1911. Type: Turin, Michigan, *Bronson Barlow*, June 21, 1901 (in U. S. Nat. Herb.).

Cynthia viridis Standley, Contr. U. S. Nat. Herb. 13: 357. 1911. Type: near Cowles, Pecos River National Forest, San Miguel Co., New Mexico, *Paul C. Standley 4418*, July 11, 1908 (in U. S. Nat. Herb.).

Krigia biflora f. *glandulifera* Fernald, Rhodora 37: 337. 1935. Type: dry sandy spruce and pine barrens near Humbolt, Michigan, *Fernald & Pease 3584*. July 3, 1934 (in Gray Herb.).

Perennial from a short caudex. Stems solitary or few, erect, striate, glabrous or with few to many and dense, widely spreading, yellowish, translucent, darkly glandular capitate hairs, especially below the involucre, 10–72 cm. tall, dividing at the axil of the uppermost reduced leaf into 2–7 cm. naked branchlets or peduncles (rarely undivided and only one peduncle present); peduncles 2–14 cm. long at flowering time, becoming slightly longer in fruit, terminating in solitary heads. Leaves chiefly basal, varying from narrowly lanceolate or oblanceolate to elliptic-oblong or broadly oblong-ovate, the larger 4–26 cm. long (including petiolar base) by 1–6 cm. wide; subsessile or with narrow petiole-like base sometimes exceeding the blade, expanded and more or less sheathing at the attachment to the stem, entire or denticulate to dentate, runcinate- or lyrate-pinnatifid with widely spreading or retrorsely curved acute or obtuse segments, thinly membranous to firm or almost succulent, occasionally undulate-margined; usually leaves of several forms and sizes present on the same plant. Stem leaves 1–4, the lower slightly narrower and shorter than the basal, the upper reduced to lanceolate or deltoid-ovate acute bracts with broad clasping base; upper-

most leafy bract about 1–4 cm. long, frequently with an additional one or two one-half to fully as long. Involucres turbinate to campanulate, 7.5–11.0 mm. high, of 10–16 lanceolate, acute, glabrous, uniseriate phyllaries about 1.5–2.8 mm. wide, with narrow scarious margins. Florets 33–60. Ligules narrowly oblong, 8–15 mm. long, truncate and deeply toothed at the apex, the teeth about 0.8–1.0 mm. long; corolla tube cylindrical, about 3.5 mm. long. Anther appendages about 0.25 mm. long; anther tails acuminate, 0.35 mm. long, about ⅛ as long as the tube. Style branches about 0.4 mm. long. Achenes round-columnar, 2.0–2.3 mm. long, dark brown-red, glabrous except for the spinulose markings, 10–15 ribbed. Pappus of 20–40 scabrous unequal bristles up to 4.5–5.5 mm. long, the shortest as little as ⅓ as long as the longest; and about 10 oblong-ovate or oblong-lanceolate, erose, brownish hyaline scales of unequal width, 0.3–0.4 mm. long.

Thickets, woods, and low prairies, Massachusetts to Georgia, Arkansas, and Minnesota, and in a detached area in Colorado and New Mexico. Reported from Manitoba by Lowe (List of the flowering plants, ferns, club mosses, mosses and liverworts of Manitoba, p. 101, 1943). Flowering in late spring and summer. A rather common and variable species, some of whose more striking variants have received separate names.

Some specimens examined: ARKANSAS: Carroll Co., Eureka Springs, *N. M. Glatfelter*, July 16, 1898 (Mo). Pope Co., Nogo, *George M. Merrill 331* (Mo). COLORADO: Fremont Co., near Canon City, *T. S. Brandegee*, June 27, 1873 (Mo). ILLINOIS: Champaign Co., Sangamon River woods, *N. A. Weston*, May, 1890 (Ill). Cook Co., Rogers Park, *A. Chase*, June 26, 1896 (Ill). Hancock Co., Carthage, *F. C. Gates 8849* (Ill). Kankakee Co., near Saint Anne, *G. N. Jones 11502* (Ill). La Salle Co., Starved Rock State Park, *Jones 15781* (Ill). Macon Co., Decatur, *Ira W. Clokey*, May 24, 1899 (Mo). Madison Co., Alton, *Benke*, May 15, 1913 (MM). Peoria Co., Peoria, *F. E. McDonald*, July 1890 (Ill). Vermilion Co., between Oakwood and Collison, *Jones 13852* (Ill). Wabash Co., in Bonpas bottoms, *Hallock Shearer*, Sept. 20, 1900 (Ill). Williamson Co., Devils Kitchem, *John McCree, Jr.*, May 19, 1941 (Mo). INDIANA: Allen Co., Robinson Park, *C. C. Deam*, June 3, 1906 (Ill). Franklin Co., 3 miles w. of Metamora, *Ray C. Friesner 13382* (WV). Jasper Co., 1 mile n. and 2 miles e. of Goodland, *Winona Welch 142* (Ill). Lake Co., Miller, *Benke*, Aug. 6, 1912 (MM). Porter Co., Dune Park, *J. M. Greenman 2599* (Mo). IOWA: Black Hawk Co., Bennington Tp., *Myrel Burk 489* (Ill). Johnson Co., Iowa City, *A. S. Hitchcock*, without number or date (Mo). Lee Co., Sugar Creek, *Rev. John Davis 2378* (Mo). MASSACHUSETTS: Middlesex Co., Framingham, *E. C. Smith*, June 12, 1893 (Mo). MICHIGAN: Ingham Co., Haslet, *T. G. Yuncker 280* (Ill). Marquette Co., Humbolt, *E. J. Hill*, July 17, 1889 (Ill); near Humbolt, *Fernald & Pease 3584* (G; type of *Krigia biflora* f. *glandulifera* Fernald). St. Clair Co., Port Huron, *C. K. Dodge*, May 25, 1896 (T). Shiawassee Co., Shaftsburg, *Yuncker 397* (Ill). MINNESOTA: Winona Co., Winona, *G. W. Freiberg*, July, 1912 (Mo). MISSOURI: Boone Co., south of Columbia, *Francis Drouet*, May 21, 1933 (Mo). Crawford Co., near Steelville, *Maude C. Lodewyks 269* (Mo). Iron Co., Arcadia, *F. M. Woodruff*, May 21, 1898 (Ill); Ironton, *Ward M. Sharp*, May 19, 1931 (WV). Jasper Co., Carthage, *E. J. Palmer 655* (Mo). Jefferson Co., 5 miles e. of Catawissa, *Julian A. Steyermark 1089* (Mo). Laclede Co., near Hazel Green, *Steyermark 8333* (Mo).

Lincoln Co., west of Foley, *Steyermark 8425* (Mo); Moscow, *Rev. John Davis 1294* (Mo). Madison Co., Mine La Motte, *Greenman*, May 19, 1927 (Mo). Marion Co., Hannibal, *Davis 4571* (Ill); north of Hanibal, *Davis 1493* (Mo); near Mark Twain's Cave, *Davis 7449* (Mo). Phelps Co., near Rolla, *Benke*, May 17, 1913 (MM). Pike Co., near Eolia, *Davis 1295* (Mo). St. Francois Co., Bismark, *Sharp*, May 19, 1931 (WV). St. Louis Co., Allenton, *H. Eggert*, May 2, 1896 (Mo). Ste. Genevieve Co., Pickle Springs, *Greenman 4893* (Mo). Schuyler Co., east of Livonia, *Steyermark 7901* (Mo). Scotland Co., 4 miles s.e. of Brock, *Steyermark 10770* (Mo). Shannon Co., Monteer, *B. F. Bush 183*, May 15, 1894 (Mo). Warren Co., Truesdale, *Davis 7335* (Mo). NEW JERSEY: Burlington Co., Palmyra, *F. J. Hermann 4154* (Mo). Wading River, *Lee P. Hynes*, March 22, 1938 (Pa). Mercer Co., Trenton, *Allena R. Slack*, without number or date (Pa). Monmouth Co., Farmingdale, *Bayard Long & Stewardson Brown 3635* (Pa). Morris Co., Rockaway, *Carrie M. Bodina*, June 27, 1927 (Pa). Somerset Co., Bound Brook, *M. A. Chrysler*, May 30, 1934, Rocky Hill, *Rev. L. H. Lighthipe*, June 16, 1914 (T). Sussex Co., 1.5 miles w. of Branchville, *A. G. Lisi 130* (Pa). Union Co., Westfield, *J. A. Drushel 4102* (Mo). NEW MEXICO: San Miguel Co., near Cowles, *Paul C. Standley 4418* (US; type of *Cynthia viridis* Standley). NEW YORK: Rockland Co., near Haverstraw, *V. O. Fosberg 126* (Pa). Westchester Co., Tibbett Brook Park, *J. Monachino 6* (Ill). NORTH CAROLINA: Buncombe Co., Biltmore, *Biltmore Herb. 560, 560b* (Mo). OHIO: Cuyahoga Co., Bedford, *L. D. Stair*, May 16, 1896 (Mo). Holmes Co., Holmesville, *J. A. Drushel 6295* (Mo). Lorain Co., Lorain, *C. A. Kofoid*, May 20, 1890 (Mo). Stark Co., near Canton, *Herb. Nicholas Riehl*, May, (Mo). PENNSYLVANIA: Berks Co., Morgantown, *E. M. Gress*, Oct. 20, 1931 (Pa.) Bucks Co., 1 mile s.w. of Rushland, *J. M. Fogg Jr. 15706* (Pa). Butler Co., 3 miles n.w. of West Winfield, *R. W. Pohl 2667* (Pa). Carbon Co., 2 miles s.w. of Little Gap, *Fogg 11954* (Pa). Chester Co., 1.5 miles s. of Chester Springs, *Fogg 18951;* 1 mile n.e. of Birckrunville, *F. R. Fosberg 14811* (Pa). Crawford Co., 4 miles e.n.e. of Meadville, *C. E. Wood Jr. 2211* (Pa). Delaware Co., n. of Swarthmore, *W. R. Taylor*, May 30, 1914 (Pa); Whitehall, *John H. Redfield*, June 5, 1866 (Mo). Indiana Co., n. of Gaibleton, *Pohl 3837* (Pa). Lancaster Co., ¾ mile n.e. of Schoeneck, *Louise F. A. Tanger*, June 1, 1938 (Pa). Mercer Co., between Mercer and Houston Junction, *A. R. Hibbard*, June 14, 1916 (Pa). Monroe Co., Merwinsburg, *Fogg 435* (Pa); Pocono Manor, *Wherry*, July 13, 1043 (Pa). Montgomery Co., Frazier's Bog, *W. Stone*, July 16, 1902 (Pa). Northampton Co., Bethlehem, *F. J. Trembley 445* (Pa). Philadelphia Co., Wissahickon, *C. D. Lippincott*, May, 1890 (Pa). Pike Co., 4 miles n.e. of Porters Lake, *Fogg 40770* (Pa); Matamoras, *Stanley L. Glowenke 3577* (Pa). Schuylkill Co., w. of Pottsville, *Paul R. Wagner 3654* (Pa). Wayne Co., Narrowsburg, *John F. Charnell 514* (Pa). Westmoreland Co., Hillside, *John Bright 8914* (Pa). TENNESSEE: Hamilton Co., Lookout Mt., *J. Schneck*, May 10, 1901 (Ill). *J. R. Churchill*, May 19, 1911 (Mo). Knox Co., Knoxville, *Albert Ruth*, June, 1896 (Mo). Roane Co., Rockwood, *W. A. Anderson & H. M. Jennison*, May 22, 1929 (Mo). Shelby Co., Memphis, *E. J. Palmer 17292* (Mo). WEST VIRGINIA: Cabell Co., Pleasant Valley, *C. M. Smithson*, May 7, 1936 (WV). Calhoun Co., Wayne, *Ray Harris*, May 27, 1933 (WV); Orma, *Harris*, May 27, 1933 (WV). Kanawha Co., Queen Shoals, *F. C. Randolph 195* (WV). Lincoln Co., Webster Creek, *Jean White*, April 29, 1938 (WV). Mingo Co., Kermit, *Harris*, June 3, 1933 (WV). Monongalia Co., Morgantown, *Nelle Ammons*,

June 1, 1925 (WV). Raleigh Co., near Glen Daniels, *John Paul Tosh*, June 8, 1940 (WV). Wayne Co., near Ceredo, *F. A. Gilbert, R. Williamson, L. R. Williams 693* (Mo, WV). Wirt Co., ½ mile south of Two Ripple School, Fern Hollow, *Elizabeth A. Bartholomew*, May 24, 1941 (WV). Webster Co., Camp Caesar, *Mr. & Mrs. H. A. Davis*, June 6, 1940 (WV). WISCONSIN: Adams Co., Adams, *A. M. Fuller 1085* (MM). Buffalo Co., Fountain City, *Benke*, June 23, 1915 (MM). Clark Co., Neillsville, *Charles Goessl 1468* (MM). Dane Co., Madison, *J. R. Heddle 2367* (MM), *William Trelease*, July 4, 1889 (Mo). Douglas Co., Upper St. Croix Lake, *Museum Expedition*, July 6–12, 1909 (MM). Grant Co., Boscobel, *C. H. Sylvester*, June, 1884 (MM). Iowa Co., across from Spring Green, *Fuller 4045* (MM). Jackson Co., 2 miles n.e. of Black River Falls, *H. H. Smith 6806* (MM). Lincoln Co., Heafford Junction, *Goessl 653* (MM). Milwaukee Co., Wauwatosa, *A. Conrath*, June 17, 1882 (MM). Monroe Co., 8 miles e. of Sparta, *Fuller 4107* (MM). Oconto Co., Oconto, *Goessl 4116* (MM). Oneida Co., Rhinelander, *Goessl 578* (MM). Portage Co., Amherst Junction, *Benke*, June 16, 1915 (MM). Shawano Co., Shawano, *Goessl 4774* (MM). Sheboygan Co., Andrae State Park, *Fuller 444* (MM). Trempealeau Co., Trempealeau, *Towne Miller*, June 3, 1928 (MM). Vernon Co., 3½ miles s. of Viroqua, *H. P. Hansen 134* (T). Vilas Co., Trout Lake, *N. C. Fassett 10782* (Mo). Washburn Co., Minong, *Goessl 7528* (MM). Washington Co., Cedar Lake, *Dr. S. Graenicher*, July 5, 1915 (MM). Waukesha Co., Town of Genesee, sect. 22, *Howland Russel*, July 5, 1915 (MM). Waushara Co., Wautoma, *Goessl 1065* (MM). Winnebago Co., Oshkosh, *R. N. Buckstaff*, July 5, 1915 (MM). Wood Co., Marshfield, *Goessl 1210* (MM).

4. KRIGIA VIRGINICA (L.) Willd., Sp. Pl. (ed. 4) pt. 3: 1618. 1803.

Hyoseris virginica L., Sp. Pl. (ed. 1) 2: 809. 1753. Based on "Hyoseris foliis lanceolatis sinuato-dentatis glabris, scapis unifloris" of Gronovius, Fl. Virg. (ed. 1) p. 90, 1739. Type: *Clayton 376*, from Virginia (not seen).

Hyoseris caroliniana Walt., Fl. Carol. p. 194. 1788. Type not seen.

Hyoseris? ramosissima Barton, Fl. Phila. Prodr. p. 75. 1915. Type not seen, but the description evidently was drawn from a rejuvenated late summer or fall plant which had developed short internodes at the base.

Krigia caroliniana Nutt., Gen. 2: 126–127. 1818. "Near St. Mary's, West Florida—Dr. Baldwyn" (type in herb. Acad. Nat. Sci. Phila., marked "W. Florida St. Marys D. B."). Not based on *Hyoseris caroliniana* Walt.; Nuttall merely remarks in discussion, "May not this be *Hyoseris caroliniana?* of Walter."

Krigia dichotoma Nutt., Gen. 2: 127. 1818. Based on *Hyoseris? ramosissima* Barton.

Krigia tenella Reichenbach, Iconographia Botanica Cent. I p. 72, pl. 87. 1823.

Krigia leptophylla DC., Prodr. 7: 88. 1838. "In Carolina meridionali olim legerunt cl. Fraser et Bosc." Specimens not seen.

Krigia virginica var. *dichotoma* "Barton"; T. & G., Fl. N. A. 2: 468. 1843. Presumably based on *Hyoseris? ramosissima* Barton, and *Krigia dichotoma* Nutt.

Krigia caroliniana var. *leptophylla* (DC.) T. & G., Fl. N. A. 2: 468. 1843. Based on *Krigia leptophylla* DC.

Adopogon carolinianum (Walt.) Britton, Mem. Torr. Bot. Club 5: 346. 1894. Based on *Hyoseris? caroliniana* Walt.

Primary or spring form (February to May, or June in the north): Stemless annual from a slender taproot which soon becomes obscured by fibrous roots. Scapes solitary, several or many, 4–35 cm. high (maximum measurements from plants in fruit), glabrous or pubescent with widely spreading, jointed, yellowish, translucent, glandular-capitate hairs, especially in the upper part. Leaves several or many in a basal rosette, sessile or with tapered petiolar base shorter than the blade; petiolar base up to 3 cm. long; blades cuneate-oblong, spatulate-oblong, or oblanceolate, 0.6–7.0 cm. long, 2–20 mm. wide, broadly acute, sharply and remotely denticulate to pinnatifid with sharply pointed divisions, ciliate with glandular-capitate hairs like those of the scapes, sometimes similarly pubescent on the mid-rib and basal part of the under-surface as well. Heads solitary, with 18–35 florets. Involucre turbinate or broadly campanulate, 4.8–6.5 mm. high in flower, 5.2–9.0 mm. in fruit; of 10 erect or suberect phyllaries in two equal series, all glabrous, long-acute, becoming widely spreading and ultimately reflexed. Outer phyllaries green, sometimes with red-brown or purple center, but never with a prominent midrib, narrowly lanceolate, up to 1.4 mm. wide, with narrow hyaline margins. Inner phyllaries ovate-lanceolate, up to 2 mm. wide, with broad hyaline margins. Corollas yellow, sometimes purplish in withering, open in the morning, or later on cloudy days. Ligules linear-oblong, 4–7 mm. long, 1.0–1.3 mm. wide, four-nerved, truncate and five-toothed at the apex; corolla tube 2.0–3.5 mm. long, with coarse, yellow, jointed translucent hairs toward the summit. Anther appendages rounded, about 0.4 mm. long; anther tails narrowly acuminate, 0.4 mm. long, about ⅕ as long as the tube. Style branches flattened, obtusely pointed, 0.2 mm. long. Achenes narrowly conical-columnar, 1.8–2.0 mm. long, 15-ribbed, more or less angular in section (due to pressure in growth), scabrous-pubescent, red-brown to reddish black. Pappus of five scabrous bristles 4.5–5.5 mm long, and five rounded-truncate hyaline scales 0.6-1.0 mm. long.

Second-flowering form (May to November): Basal part of stem elongate, with distinct internodes, bearing one to three or four alternate, subopposite, or (by elevation of the basal rosette) apparently opposite leaves, from a few millimeters to as much as 5 cm. above the base; leaves usually much smaller than the soon-withering spring leaves, or very old plants quite leafless. New scapes flowering when taller than in the equivalent spring form, and not elongating as much afterward. Involucres as little as 4 mm. high, with 16–25 florets.

A common, rather weedy little plant of sandy soils, Florida to Texas, north (according to Gray's New Manual of Botany, 7th ed., p. 862, 1907) to Minnesota and southern Maine; reported from the state of Washington by Britton and Brown (Illustrated Flora, 2nd ed., vol. 3, p. 307, 1913). Rather local in occurence in the northern part of its range, though usually abundant where found.

Some specimens examined: ALABAMA: Lee Co., Auburn, *S. F. Earle &*

C. F. Baker, April 12, 1897 (Ill). Mobile Co., Mobile, *J. Schneck*, May 11, 1901 (Ill). ARKANSAS: Pope Co., Nogo, *George M. Merrill 333* (Ill). DISTRICT OF COLUMBIA: Rock Creek, *C. H. Sylvester*, April 26, 1886 (MM). Takoma, *W. S. Moffat 133* (Ill). South of Congress Heights, *Hitchcock*, May 3, 1905 (Ill). FLORIDA: without locality, *W. W. Calkins*, without number or date (Ill). ILLINOIS: Cass Co., Beardstown, *F. E. McDonald*, June, 1901 (Ill). Fulton Co., without locality, *William Wolf*, without number or date (Ill). Lasalle Co., Utica, *E. W. Andrews*, June 12, 1877 (Ill). Mason Co., Havana, *T. J. Burrill*, June 13, 1894 (Ill). INDIANA: Lagrange Co., 5 miles n.e. of Howe, *Friesner 18990* (T). Lake Co., Gary, *William Finger*, June 27, 1908 (MM), *F. C. Gates*, June 16, 1906 (Ill); Miller, *Moffatt 1644* (Ill), *Chase 1771* (Ill). Pulaski Co., 1 mile w. of Thornhope, *Friesner 14462* (WV). MASSACHUSETTS: Berkshire Co., Williamstown, 1857, collector not named (Ill). Franklin Co., Leyden, *S. J. Ewes 502* (Ill). Middlesex Co., Lexington, *H. H. Bartlett 481* (Ill). MICHIGAN: Mason Co., near Ludington, *G. D. Fuller 1749* (Ill). Muskegon Co., Whitehall, *Yuncker 682* (Ill). MISSOURI: Newton Co., Grand Falls, *Bush 10455*, May 5, 1926 (Ill). NEW JERSEY: Atlantic Co., Alberton Brook, *E. L. Core 5030* (WV). Burlington Co., Pemberton, *Herb. H. M. Willmarth*, May 8, 1884 (Ill). Middlesex Co., Woodbridge Tp., *Lighthipe*, May 30, 1890 (Ill). Morris Co., Boonton, *W. T.* (*release*?), 1913 (Ill). NEW YORK: Albany Co., near Loudonville, *Homer D. House 26495* (T). NORTH CAROLINA: Orange Co., Chapel Hill, *L. M. Stewart*, April 23, 1938 (MM). RHODE ISLAND: Kent Co., *A. W. Congdon*, without number or date (Ill). SOUTH CAROLINA: Anderson Co., near Anderson, *Rev. John Davis 1339* (Ill). TENNESSEE: Hamilton Co., Lookout Mt., *Schneck*, May 11, 1901 (Ill). Lewis Co., Meriwether Lewis National Monument, *Elsie Quarterman*, May 13, 1945 (T). TEXAS: Anderson Co., 3 miles e. of Palestine, *Shinners 7047* (SMU). Angelina Co., 13 miles s.e. of Zavalla, *Shinners 7027* (SMU). Austin Co., Industry, *Hugo Wurzlow*, 1891 (Ill). Bastrop Co., Bastrop, *Tharp*, June 3, 1923 (T); east of Bastrop, *Lundell & Lundell 10333* (SMU); 5 miles s.e. of Elgin, *Shinners 7262* (SMU). Burnet Co., on the Colorado River west of Burnet, *Shinners 7216* (SMU). Caldwell Co., Fentress, *Edward Mercer*, March 29, 1931 (T). Cherokee Co., e. of Jacksonville, *J. F. Brenckle 47–336* (SMU); 1 mile w. of Rusk, *Shinners 7010* (SMU). Freestone Co., 12 miles s. of Fairfield, *Shinners 7106* (SMU). Guadalupe Co., near Seguin, *Whitehouse 11055* (SMU). Hardin Co., without locality, *Whitehouse*, April 4, 1931 (T). Jasper Co., 6 miles n. of Jasper, *Shinners 7645* (SMU). Leon Co., 6 miles n.e. of Buffalo, *Shinners 7120* (SMU). Llano Co., Enchanted Rock, *Tharp*, June 11, 1930 (T); Shepherd, collector not named, April 10, 1936 (T). Newton Co., 2 miles w. of Newton, *Shinners 7654* (SMU). Polk Co., Indian Reservation, *E. B. Girvin*, April 12, 1940 (T). San Augustine Co., 4 miles n. of San Augustine, *Shinners 7629* (SMU). Tarrant Co., 3 miles n.w. of Grapevine, *Shinners 7076* (SMU). Wood Co., 3 miles n. of Mineola, *Shinners 7521* (SMU). WEST VIRGINIA: Berkely Co., Martinsburg, *H. Ison Shreve*, May 16, 1937 (WV). Hardy Co., Reymann Memorial Farm, *West Virginia University Botanical Expedition*, July 1, 1927 (WV). Kanawha Co., near Charleston, *Core*, May 6, 1939 (WV). Mineral Co., Ridgeville, *Southern Appalachian Botanical Club Foray*, May 31, 1940 (WV). WISCONSIN: Iowa Co., north of Arena, *Shinners 352* (MM). Richland Co., Lone Rock, *J. J. Davis*, May 29, 1922 (MM). Sauk Co., Spring Green, *Davis*, May 22, 1922 (MM).

Section 2. CYMBIA T. & G., Fl. N. A. 2: 467. 1843. (With symbol-designation of rank only; referred to as "sectio *Cymbia*" by Scheele, Linnaea 25: 257, 1853.) Type species: *K. occidentalis* Nutt.

Krigia sect. *Bellidion* Scheele, Linnaea 25: 257. 1853. Type species: *K. bellidioides* Scheele (= *K. occidentalis* Nutt.).

The generic names *Cymbia*, *Apogon*, and *Serinia* also relate to this section.

Phyllaries remaining erect and expanded in age, the midrib becoming prominent and keel-like. Pappus wanting, or of scales only, or of short bristles and an equal number of hyaline scales ⅓ or more as long.

5. KRIGIA OCCIDENTALIS Nutt., Journ. Acad. Nat. Sci. Phila. 7: 104. 1834. Type and isotypes collected by Nuttall in "Arkansa" (herb. Acad. Nat. Sci. Phila., and Gray Herb.).

Krigia nervosa Hook., Icones Pl. vol. 3, *pl. 237*. 1840. "San Felipe de Austin, Texas, *Drummond* (Coll. III, n. 164)" (isotype in Gray Herb.; part of this same collection forms the type of *K. occidentalis* var. *mutica* T. & G.).

Krigia occidentalis var. *mutica* T. & G., Fl. N. A. 2: 468. 1843. "Texas, *Drummond* (no. 164, in Gray Herb.; some of the plants under this number are the typical form).

Krigia bellidioides Scheele, Linnaea 25: 257. 1853. "Auf feuchtem Muschelsand, Galveston island, Texas," *F. Römer*, April, 1846. Type not seen.

Adopogon occidentale (Nutt.) Kuntze, Rev. Gen. Pl. 1: 304. 1891. Based on *Krigia occidentalis* Nutt.

Cymbia occidentalis (Nutt.) Standley, Contr. U. S. Nat. Herb. 13: 354. 1911. Based on *Krigia occidentalis* Nutt.

Krigia occidentalis f. **mutica** (T. & G.) Shinners, comb. nov. Based on *Krigia occidentalis* var. *mutica* T. & G., Fl. N. A. 2: 468. 1843.

Stemless annual from a predominately fibrous root system (very densely tufted plants may be divided at base into a few short stubs as much as 1 cm. long, or even 2.5 cm. when buried by overwashed sand). Scapes 4–16 cm. high, erect or ascending, glabrous or pubescent with widely spreading, jointed, yellowish, translucent, glandular-capitate hairs, especially above. Leaves few or many in a basal rosette, with narrow petiolar bases 0.5–7.0 cm. long, nearly as long to slightly more than twice as long as the blades; blades linear-lanceolate, oblong-lanceolate, elliptic, or spatulate, 0.5–6.0 cm. long, 0.1–1.8 cm. wide, obtuse or subacute, entire to sinuately lobed or deeply pinnatifid with narrow segments, one-ribbed, the larger ones more or less distinctly feather-veined, glabrous or the petiolar base sparingly ciliate with jointed glandular hairs like those of the scapes. Several leaf forms often present on the same plant, the later ones usually more finely divided. Heads solitary, with 6–26 florets. Involucre turbinate or campanulate, or (when half closed in early fruit) subglobose, 2.5–5.5 mm. high in flower, 4.3–6.5 mm. in fruit; usually of 5, occasionally of 4 or 6, rarely 7 or 8, phyllaries united in the basal ¼ to ⅓, more or less overlapping laterally, remaining erect in fruit, the involucre becoming closed by shrivelling after the seeds are

shed. Phyllaries lanceolate to ovate-lanceolate, 1.2–1.8 mm. wide in flower, 1.5–2.0 mm. in fruit; green except in the narrow scarious margins, becoming brown or scarlet in age, with dark tips or centers, and at maturity with 1 or 2 prominent ribs, glabrous or sparingly pubescent on the back with jointed, glandular hairs like those of the scape, and minutely glandular-ciliolate at the apex. Corollas orange-yellow, open during the morning, or later on cloudy days. Ligules oblong, 3.5–3.8 mm. long, 1.5–1.8 mm. wide, 4-nerved, truncate and deeply and unevenly 5-toothed at the apex, the teeth 0.6–1.0 mm. long; corolla tube 1 mm. long, pubescent toward the summit with coarse jointed hairs. Anther appendages rounded about 0.3 mm. long; anther tails filiform-attenuate, 0.3 mm. long, about $\frac{1}{6}$ the length of the tube. Style branches flattened, rhombic, obtuse, barely 0.2 mm. long. Achenes conical-columnar, 1.3–1.7 mm. long, slightly flared at summit, 10- or 15-ribbed and more or less angular, cinnamon or red-brown at maturity. Pappus of 5 scabrous bristles, 1.2–2.0 mm. long, rarely shorter, often unequal, the shortest as little as $\frac{1}{2}$ as long as the longest; and 5 transparent, flabelliform scales 0.4 0.6 mm. long, slightly broader than long.

Sandy open ground, a rather common weed, eastern Texas, Oklahoma, and adjacent Missouri and (according to Small, Flora of the southeastern United States, ed. 2, p. 1319, 1913) Arkansas. Often found with the smaller-flowered *K. oppositifolia*, stunted plants of which may closely resemble this species.

Some specimens examined: MISSOURI: Jasper Co., Joplin, *E. J. Palmer 3936* (Ill). OKLAHOMA: Alfalfa Co., Aline, *Stevens 3003* (Ill). Logan Co., Guthrie, *Carleton*, May 1891 (Ill). Pottawatomie Co., 3 miles s. of Shawnee, *Darrell McLean*, June 16, 1938 (T). TEXAS: Anderson Co., 3 miles e. of Palestine, *Shinners 7046* (SMU). Austin Co., Industry, *Wurzlow*, 1891 (Ill); Bellville, *Tharp*, April 10, 1936 (partly f. *mutica*, partly short-awned *K. occidentalis*). Bastrop Co., s. of Bastrop State Park, *B. C. Tharp, Barton H. Warnock*, and *Fred A. Barkley 16T018* (T); 6 miles s.e. of Elgin, *Shinners 7263* (SMU); Smithville, *Mrs. D. Marrs*, May 12, 1930 (partly f. *mutica*). Bell Co., without locality, *S. E. Wolff 2770* (TAM). Brazoria Co., Alvin, *Tracy 8997* (T, TAM), *M. S. Young*, April 22, 1918 (Ill, T). Burleson Co., Somerville, "*S. Hi.School*," April 1, 1930 (T). Burnet Co., Inks Lake State Park, *Shinners, 7218* (SMU). Caldwell Co., without locality, *J. B. McBryde*, 1931 (T). Calhoun Co., Magnolia Beach, *Whitehouse 11045* (SMU). Cooke Co., Gainesville, *E. E. Russell*, May 8, 1923 (T). Eastland Co., 3½ miles e. of Ranger, *Parks & Cory 13183* (TAM). Franklin Co., 3 miles e. of Mt. Vernon, *Shinners 7488* (SMU). Freestone Co., 12 miles n.w. of Fairfield, *Shinners 7101* (SMU). Hood Co., Granbury, *Iwania Cooper*, April 5, 1930 (T). Hopkins Co., 7 miles e. of Sulphur Springs, *Shinners 7467* (SMU). Hunt Co., 8 miles e. of Greenville, *Shinners 7463* (SMU). Leon Co., 6 miles n.e. of Buffalo, *Shinners 7119* (SMU); 17 miles s.w. of Buffalo, *Shinners 7136* (SMU). Llano Co., east of Llano, *Shinners 7197* (SMU). Morris Co., 3 miles n.w. of Daingerfield, *Shinners 7500* (SMU). Navarro Co., 9 miles s. of Corsicana, *Shinners 7094* (typical), *7096* (f. *mutica*) (SMU). Robertson Co., 7 miles n.e. of Hearne, *Shinners 7146* (SMU). Tarrant Co., Handley, *Albert Ruth 442*, April 6, 1914 (Ill). Titus Co., 3 miles s. of Mt. Pleasant, *Shinners 7503* (SMU). Travis Co., Austin, *White-*

house 11054 (SMU), *H. H. York*, Feb. 22, 1908 (T), *Warnock 20616* (T). Van Zandt Co., 3 miles e. of Wills Point, *Shinners 7539* (SMU). Washington Co., near Brenham, *C. C. Albers 46024* (T). Wood Co., 2 miles w. of Mineola, *Shinners 7525* (SMU); 7 miles s.w. of Winnsboro, *Lundell & Lundell 13724* (SMU).

6. KRIGIA OPPOSITIFOLIA Raf., Fl. Ludov. p. 57. 1817 (With question mark after generic name.) Based on "Anonyme" of Robin, Flore Louisianaise (in Voyage dans l'Interieur de la Louisiane) p. 324. 1807.

Serinia cespitosa Raf., Fl. Ludov. p. 149. 1817. Substitute name for *Krigia? oppositifolia* Raf.

Apogon humilis Ell., Sketch Bot. S. C. & Ga. 2: 267. 1822? (dated 1824). "Between Jacksonborough and Ashepoo-ferry. Sent to me recently from Augusta, Georgia, by Dr. Leavenworth." (Photo of specimen without label in Charleston Museum by Una F. Weatherby, marked "probably the type" by C. A. Weatherby; in herb. N. Y. Bot. Gard.).

Apogon lyratum Nutt., Journ. Acad. Nat. Sci. Phila. 7: 71. 1834. "The plains of the Arkansa"; apparent isotype in Gray Herb. *Serinia cespitosa* Raf. cited as synonym with query.

Laxanon parviflorum Raf., New Fl. N. A. 2: 16. 1837 (dated 1836). "Sent me from Alabama." Type not seen.

Laxanon diversifolium Raf., New Fl. N. A. 2: 46. 1837 (dated 1836). "In Arkanzas, collected by Nuttall, found in Collins herb. among the Krigias as a N. G. not named." Doubtless Rafinesque saw part of the type collection of *Apogon lyratum* Nutt.

Laxanon heterophyllum Raf., New Fl. N. A. 4: 106. 1838 (dated 1836). "Arkanzas . . . . . Found in Coll. herb., ... deemed a doubtful plant near Krigia by Nuttal." Evidently the same as *Laxanon diversifolium* Raf., renamed through oversight.

Krigia petiolaris Raf., New Fl. N. A. 4: 86. 1838 (dated 1836). "In Alabama." Type not seen.

Apogon Wrightii A. Gray, Syn. Fl. N. A. 1 pt. 2: 411. 1884. Type: east Texas, *Charles Wright* (in Gray Herb.).

Serinia oppositifolia (Raf.) Kuntze, Rev. Gen. Pl. 1: 364. 1891. Based on *Krigia? oppositifolia* Raf.

Serinia Wrightii (A. Gray) Kuntze, Rev. Gen. Pl. 1: 364. 1891. Based on *Apogon Wrightii* A. Gray.

Primary or spring form (February to June, sometimes later): Annual from a predominantly fibrous root system. Stems erect to half decumbent, in dry open ground contracted and crowded, appearing almost stemless, but usually stems simple to remotely and freely branching from the base, 3.5–4.0 cm. tall, glabrous or sparingly pubescent with widely spreading, yellowish, translucent, jointed, glandular-capitate hairs. Ultimate branchlets (peduncles) solitary or in 2's or 3's, naked for 2–15 cm. below the heads at flowering time, usually rather densely glandular-pubescent. Lower leaves alternate or subopposite, sessile or with winged and clasping petiolar bases up to 5.5 cm. long; blades linear-lanceolate to elliptic, or the first ones even

suborbicular, up to 14 cm. long by 1.7 cm. wide, obtuse or acute, entire to remotely denticulate, sinuately lobed, or deeply pinnatifid, wholly glabrous. Upper leaves smaller, sessile, more or less clasping, the uppermost usually opposite and unequal in size, elliptic or narrowly oblong to lance-linear, often with small opposite or axillary leafy bracts, somewhat resembling *Krigia biflora*. Heads with 14–23 florets. Involucres urn-shaped, 3.0–4.3 mm. high in flower, 3.4–5.3 mm. in fruit; of 5–8 phyllaries in one or two series of equal length, glabrous except the ciliolate apex, in age with a prominent raised midrib, remaining erect in fruit. Outer phyllaries green, lanceolate to ovate-lanceolate, acute; inner phyllaries scarious-margined, broadly lanceolate to ovate, obtuse. Corollas medium to dark yellow. Ligules oblong, 2–4 mm. long, 1–2 mm. wide, 4-nerved, truncate and deeply 5-toothed at the apex, the teeth 0.4–1.0 mm. long; corolla tube 0.7–1.0 long, with coarse jointed hairs in the upper part. Anther appendages rounded-oblong, 0.2 mm. long; anther tails 0.25 mm. long, about ¼ as long as the tube. Style branches more or less flattened, oblong-acute or rounded, 0.2 mm. long. Achenes ovoid-columnar, 1.4–1.6 mm. long, strongly 10- or 15-ribbed, cinnamon-red to dark red-brown at maturity. Pappus none or a minute scaly crown as much as 0.2 mm. long.

Late season form (May to November): Larger leaves mostly withered; branches very numerous, shorter; heads more numerous, smaller, and fewer-flowered (involucres as little as 2.6 mm. high, with as few as 7 florets).

An exceedingly common little weed, especially on sandy soils, but occurring almost anywhere in disturbed ground, from Florida to central Texas, central Kansas, southern Illinois, Tennessee, and North Carolina. Highly variable in stature and habit, according to season, crowding, and habitat.

Some specimens examined: ALABAMA: Lee Co., Auburn, *Earle & Baker*, May 8, 189– (Ill). Mobile Co., Mobile, *Earle 2010* (Ill). ARKANSAS: Drew Co., Monticello, *Demaree 25363* (SMU). Hempstead Co., Hope, *G. W. Letterman*, May 7, 1884 (NY). Hot Springs Co., Magnet Cove, *Demaree 14801* (NY). Logan Co., Magazine Mt., *H. R. Pyle 222* (T). Mississippi Co., Craighead, *Eggert*, May 7, 1893 (NY). Pulaski Co., Little Rock, *Dr. H. E. Haase*, April 28, 1885 (NY). FLORIDA: Gadsden Co., near Chattahooche, *A. H. Curtiss 2nd Distrib. pl. s. U. S. 6395* (Ill, NY). GEORGIA: Bibb Co., below Macon, *John K. Small*, May 18–24, 1895 (NY). Richmond Co., 4 miles below Augusta, *Roland M. Harper 1307* (NY). ILLINOIS: Union Co., west of Jonesboro, *H. A. Gleason 8982* (NY). KANSAS: Cherokee Co., without locality, *Hitchcock, Pl. Kans. 744* (NY). Cowley Co., without locality, *C. N. Gould*, 1896 (NY). La Bette Co., Parsons, *Schneck*, May 10, 1894 (Ill). Sedgewick Co., Wichita, *Carleton*, May 15, 1888 (Ill). Crawford Co., 6 miles s.e. of Pittsburg, *P. A. Rydberg & Ralph Imler Fl. Kans. 190* (NY). LOUISIANA: Beauregard Parish, ½ mile s.w. of Merryville, *Shinners 7664* (SMU). Iberville Parish, Plaquemine, *J. H. Barnhart 2823* (NY). Natchitoches Parish, Natchitoches, *E. J. Palmer 7220* (NY). Rapides Parish, vicinity of Alexandria, *C. R. Ball Pl. La. 395* (NY). St. Tammany Parish, vicinity of Covington, *Bro. G. Arsene 11905* (NY). MISSISSIPPI: Choctaw Co., French Camp, *Ida*

Martin Clute 57 (NY). Oktibbeha Co., Starkville, collector not named, April 17, 1858 (Ill). MISSOURI: McDonald Co., Noel, *Bush 7537*, May 10, 1915 (Ill, NY). Perry Co., opposite Grand Tower, Ill., *Gleason*, May 7, 1902 (Ill). NORTH CAROLINA: Halifax Co., Weldon, *E. B. Bartram*, April 18, 1908 (NY). OKLAHOMA: Creek Co., Sapulpa, *Bush 873*, April 28, 1895 (NY). McCurtain Co., near Shawneetown, *H. W. Houghton*, May 26, 1916 (NY). Sequoyah Co., near mouth of Illinois River, *G. J. Goodman & Fred Barkley 2133* (NY). TENNESSEE: Chester Co., Henderson *S. M. Bain 68* (NY). Lewis Co., Hohenwald, *Elsie Quarterman 1221* (T). TEXAS: Anderson Co., Jacksonville, *Ottys & Ruth Sanders*, April 2, 1939 (SMU); Palestine, *Tharp*, April 14, 1929 (T), *K. E. Smith*, April 21, 1935 (T). Bastrop Co., 4 miles s.e. of Elgin, *Shinners 7250* (SMU). Bell Co., 2 miles n. of Belton, *Wolff 577* (TAM). Bowie Co., Texarkana, *Shinners 7868* (SMU). Brazoria Co., Columbia, *Bush 79*, April 9, 1899 (NY). Brazos Co., 6 miles w. of College Station, *Cory 51600* (SMU). Burnet Co., Inks Lake State Park, *Shinners 7225* (SMU). Camp Co., 5 miles w. of Pittsburg, *Shinners 7508* (SMU). Chambers Co., Double Bayou, *Tharp*, April 7–10, 1936 (T). Cherokee Co., 1 mile w. of Rusk, *Shinners 7011* (SMU). Dallas Co., n. and w. of Irving, *Shinners 9131* (SMU); n. of Seagoville, *Shinners 7062* (SMU); s.w. of Seagoville, *Lundell & Lundell 13751* (SMU). Denton Co., 4½ miles n. of Grapevine, near Tarrant Co. line, *Shinners 9220* (SMU). Falls Co., 9 miles s.e. of Marlin, *Shinners 7163* (SMU). Franklin Co., 2 miles e. of Mt. Vernon, *Shinners 7485* (SMU); *Lundell & Lundell 13703* (SMU). Freestone Co., 12 miles n.w. of Fairfield, *Shinners 7100* (SMU), *7099* (SMU); 15 miles w. of Fairfield, *Shinners 7110* (SMU). Frio Co., 11 miles w. of Dilley, *Lundell & Lundell 13608* (SMU). Galveston Co., Galveston, *Tracy 8998* (NY); Virginia Point, *W. L. Bray 19* (T). Gonzales Co., Gonzales, *Tharp*, March 28, 1930 (T). Harris Co., Houston, *Whitehouse 11049* (SMU), *Elihu Hall 376* (NY), *E. J. Palmer 11928* (NY); Goose Creek, *R. E. Lee High School*, April, 1930 (T); near the mouth of the San Jacinto River, *Whitehouse 11047* (SMU). Harrison Co., 4½ miles n.e. of Marshall, *Shinners 7566* (SMU). Henderson Co., 4 miles w.s.w. of Chandler, *Shinners 9103* (SMU); 3½ miles n.w. of Athens, *Shinners 9111* (SMU). Hopkins Co., 7 miles e. of Sulphur Springs, *Shinners 7468* (SMU). Houston Co., Crockett, *Tharp*, April 20, 1933 (T). Hunt Co., 8 miles e. of Greenville, *Shinners 7460* (SMU); 3 miles s.w. of Caddo Mills, *Shinners 7487* (SMU), *7456* (SMU). Jasper Co., Jasper, *Shinners 7642* (SMU). Jefferson Co., 16 miles s.w. of Beaumont, *Shinners 7708* (SMU). Kaufman Co., 8 miles e. of Terrell, *Shinners 7544* (SMU); Terrell, *Mary Frances Camp*, April 10, 1944 (NT). Lamar Co., Paris, *E. McMullen*, April 18, 1927 (T). Lavaca Co., 5 miles s.e. of Hallettsville, *Paul Person & Grady L. Webster 2047* (SMU). Leon Co., 6 miles n.e. of Buffalo, *Shinners 7128* (SMU). Llano Co., ½ mile s. of Buchanan Dam on the Colorado River, *Shinners 7199* (SMU). McLennan Co., Waco, *J. Schneck*, May 10, 1894 (Ill). Medina Co., 3 miles w. of Castroville, *Lundell & Lundell 13545* (SMU). Montgomery Co., 7 miles s. of Conroe, *Shinners 7741* (SMU). Morris Co., 3 miles n.w. of Daingerfield, *Shinners 7499* (SMU). Navarro Co., 3 miles n. of Corsicana, *Shinners 7091* (SMU). Orange Co., near Orange, *Whitehouse 11050* (SMU); 6 miles w. of Orange, *Shinners 7683* (SMU). Panola Co., 23 miles n.e. of Carthage, *Shinners 7582* (SMU). Polk Co., without locality, *Tharp*, April 25, 1937 (SMU, T). Robertson Co., Calvert, *F. J. H. Merrill*, March 27, 1886 (NY); 9 miles n.w. of Hearne, *Shinners 7152* (SMU); 8 miles s.w. of Franklin, *Lundell & Lundell 13444* (SMU); 14 miles n.e. of Franklin, *Shinners 7142* (SMU). Sabine

Co., just n. of Jasper Co. line, 16 miles n. of Jasper, *Shinners 7632* (SMU). San Jacinto Co., Cold Springs, *Whitehouse 11048* (SMU). Tarrant Co., between Grapevine and Roanoke, *Lundell & Lundell 13746* (SMU). Titus Co., 8 miles s.e. of Mt. Pleasant, *Shinners 7495* (SMU); 3 miles s. of Mt. Pleasant, *Shinners 7504* (SMU). Travis Co., Colorado River at Mt. Bonnell (Austin), *Tharp*, May 3, 1936 (T). Van Zandt Co., Grand Saline, *Raborn-Reynolds*, May (T); 3 miles e. of Wills Point, *Shinners 7542* (SMU). Walker Co., 1 mile n. of Waverly, *Shinners 7750* (SMU). Wood Co., 7 miles s. w. of Winnsboro, *Lundell & Lundell 13723* (SMU); 2 miles w. of Mineola, *Shinners 7524* (SMU).

7. **Krigia gracilis** (DC.) Shinners, comb. nov.

Apogon gracilis DC., Prodr. 7: 79. 1838. Type: "in Mexico inter Bejar et Austin," *Berlandier*. Probable isotype in Gray Herb., *Berlandier 361*, "de Bejar a Austin, Texas, Avril, 1828."

Serinia gracilis (DC.) Kuntze, Rev. Gen. Pl. 1: 364. 1891. Based on *Apogon gracilis* DC.

Primary or spring form (April to June): Annual from a predominantly fibrous root system. Stems erect or ascending, usually freely branching, 8–40 cm. tall, the ultimate branches (peduncles) solitary or 2–3 together, naked for 2.5–16 cm., glabrous or (especially below the heads) with widely spreading, translucent, glandular-capitate hairs. First basal leaves (soon withering) usually with a distinct petiolar base and entire, lanceolate to elliptic blade; lower stem leaves alternate or subopposite, sessile or with petiolar bases up to 5 cm. long, much expanded at the attachment to the stem and clasping, the blades lance-linear to narrowly oblong-lanceolate, 1.5 7.0 cm. long, 0.3–2.0 cm. wide, obtuse or acute, entire to denticulate, lobed or deeply pinnatifid, glabrous or sparsely puberulent with rather stout, jointed, translucent hairs. Upper leaves subopposite or opposite, sessile and clasping, entire or denticulate. Heads with 17–35 florets. Involucres broadly urn-shaped, 5.3–8.3 mm. high in flower, 6.3–8.5 mm. in fruit. Phyllaries 8–10, in one series but with overlapping scarious margins, ovate or ovate-lanceolate, 1.5–2.4 mm. wide, glabrous. Corollas deep yellow or orange-yellow, open during the morning or later on cloudy days. Ligules narrowly oblong, 5–10 mm. long, 1.3–2.5 mm. wide, four-nerved, truncate and deeply five-toothed at the apex, the teeth 0.6–2.0 mm. long; corolla tube 0.5–0.6 mm. long, coarsely pubescent toward the summit with jointed translucent hairs. Anther appendages about 0.35 mm. long; anther tails slenderly acuminate, 0.4 mm. long, about ⅕ as long as the tube. Style branches more or less flattened, rounded-oblong, 0.2 mm. long. Achenes ovoid-columnar, 1.4–1.7 mm. long, strongly 15-ribbed, minutely hispid-pubescent, with dark red-brown. Pappus none or an obscure scaly crown.

Late-season form (May and later): Larger leaves withered: branches shorter, but not much more numerous; heads slightly smaller and fewer-flowered on the average (involucres as little as 4.5 mm. high, florets fewer than 30). Not as prevalent as the corresponding form in *K. oppositifolia*.

Blackland prairies of central Texas, and islands of similar clay soil in south-central Texas, preferring somewhat damp places; less common in

adjacent regions of sandy soil through central Texas, but spreading as a weed in ditches, fields, and disturbed ground. Usually abundant where found, but rather local in occurrence, growing by itself or with *K. oppositifolia*. *Krigia gracilis* is obviously a close congener of *K. oppositifolia*, from which it differs in little but its more robust appearance, much larger flowering heads (which make it easily distinguishable in the field when both species are found together), and generally deeper color of the corollas. Even when growing intermingled, the two do not intergrade.

Some specimens examined: TEXAS: Austin Co., Bellville, *Tharp*, April 8, 1939 (SMU, T). Bell Co., 2 miles n. of Holland, *Wolff 2919* (TAM). Burleson Co., 3 miles n.e. of Lyons, *Cory 51646* (SMU). Burnet Co., Spicewood Springs, *M. S. Young*, April 4, 1914 (T). Comal Co., New Braunfels, *F. Lindheimer exs. 867* (G, Mo, T). Dallas Co., 5 miles n.w. of Dallas, *Shinners 7089* (SMU); Highland Park, Dallas, *Shinners 8494* (SMU); n. of Seagoville, *Shinners 7061* (SMU); near Seagoville, *Lundell & Lundell 10395* (SMU). Denton Co., without locality, *B. B. Harris*, spring 1926 (NT). Gonzales Co., Ottine, *Bogusch*, March 27, 1927 (T). Grimes Co., near Navasota, *Ecology Class*, April 20, 1930 (T). Harris Co., Goose Creek, *R. E. Lee High School*, April, 1930 (T). Hunt Co., s.w. of Caddo Mills, *Lundell & Lundell 13675* (SMU); 3 miles s.w. of Caddo Mills, *Shinners 7453* (G, Ill, MM, Mo, SMU, T, WV). Jack Co., 2 miles n.w. of Jacksboro, *Whitehouse 15280* (SMU). Kaufman Co., 7 miles w. of Terrell, *Shinners 7548* (SMU). Milam Co., Rockdale, *Mrs. Charles Murphree*, April 16, 1931 (T). Navarro Co., 6 miles s. of Richland, *Cory 51541* (SMU). Tarrant Co., Arlington, *Ruth 1586*, April 2, 1929 (SMU). Travis Co., Austin, *M. S. Young 157* (Ill; same, without number, T); *Tharp*, April 1, 1930 (T), April 12, 1942 (T). Walker Co., s. of New Waverley, *J. B. McBryde*, April 12, 1941 (SMU). Washington Co., without locality, *Whitehouse*, April 3, 1931 (T).

NEWS

On July 1, 1946 the Institute of Technology and Plant Industry of Southern Methodist University was absorbed by the Texas State Research Foundation. The herbarium, formerly a part of the Institute, was retained by Southern Methodist University as a department in the Graduate School. The staff of the University Herbarium is as follows: Dr. C. L. Lundell, Director; Dr. Lloyd H. Shinners, Research Fellow; Mr. V. L. Cory, Field Botanist; Dr. Eula Whitehouse, Mrs. B. W. James, and Mrs. Ruth G. Munnell, Assistants. Mrs. Amelia A. Lundell, who held the position of Assistant to the Director, resigned on June 30, 1947. In addition to his connection with Southern Methodist University as Director of the University Herbarium and Professor of Botany, Dr. Lundell is Director of the Texas State Research Foundation with headquarters at Renner, Texas.

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WILD ROSE PASS OF TEXAS, AN OBSCURE LOCALITY AND ITS ACTUAL POSITION

ROGERS MCVAUGH

The pages of Asa Gray's *Plantae Wrightianae* and John Torrey's *Botany of the Boundary*, published in 1852 53 and 1859, respectively, bear numerous references to a locality called "Wild Rose Pass", in western Texas. Like so many of the localities where plants were collected by the botanists of the Mexican Boundary Survey between 1849 and 1853, "Wild Rose Pass" is not to be found on modern maps, and the modern worker who attempts to locate it precisely finds himself involved in tedious, and it may be unfruitful, historical research. The present paper is an attempt to fix the actual position of this locality.

The approximate position of Wild Rose Pass is not hard to determine: on the first page of the enumeration of species in the *Plantae Wrightianae*, under *Streptanthus linearifolius* A. Gray, is the notation "Valley of the Limpia or Wild Rose Creek; Aug." Now, as Geiser[1] has told in detail of Wright's travels of 1849 with the military party of Captain French, it is simple to ascertain that the "Pass of the Limpia" (so often referred to in the *Plantae Wrightianae*) is identical in meaning with "Wild Rose Pass". This pass, or canyon, of Limpia Creek, is of course the canyon followed by the modern highway northeasterly from Fort Davis, Jeff Davis County, toward Balmorhea. If we turn, however, to the reports of Wright's contemporaries, we find them using the name Wild Rose Pass in a more restricted sense; they seem not to have applied it to the whole Limpia Canyon (which extends for more than 10 miles below Ft. Davis), but chiefly to the deepest and at the same time steepest part of the canyon, where the Limpia breaks out into the plain.

For example, see the remarks of Parry[2] in his discussion of the route through the "Limpia mountains":

"The passage of this range is accomplished by a series of rather steep and rough ascents, following up the course of the Limpia valley. The main pass, known as the '*Wild Rose Pass*', exhibits gigantic walls of rock, tower-

[1]Geiser, S. W. Charles Wright's 1849 botanical collecting-trip from San Antonio to El Paso; with type-localities for new species. Field & Lab. 4: 23–32. 1935.

[2]Parry, C. C. General Geological Features of the Country; in Emory, Report on the United States and Mexican Boundary Survey 1(2): 4. 1857 (House Exec. Doc. 135, 34th Congr., 1st Session, Serial No. 861).

ing up on either hand to the height of 1,000 feet or more above the valley below."

Better than this, however, is the much fuller description given by the leader of Wright's party, Captain French himself. In his report on this first attempt to convey a major military party over the newly discovered route between San Antonio and El Paso, French[3] describes the journey over the flat country west of what is now Fort Stockton, and the appearance of the Limpia, the first water after leaving Leon Spring, 10 miles west of Fort Stockton:

"At the point where the road strikes the Limpia, it is a small stream, rising from its rocky bed, and, flowing a short distance, soon disappears."

French's account continues (p. 47):

"Leaving the valley, the road enters the Wild Rose pass. But few places can present anything more lovely than this little valley, surrounded as it appears to be by a wall of vertical rocks, rising a thousand feet in altitude—these rocky walls partly forming the sides of mountains that rise still higher, and overlook the valley from every point. From here the road leads over a spur of the mountains, and descends on the other side, and, continuing up the bed of the stream several miles, through a deep, narrow cañon, leads to a more elevated plain, in which this little stream takes its rise. This cañon in some places is not more than two hundred yards in width. Columnar basaltic rocks, that rise one behind the other to many feet in altitude, form its sides, and present a singular appearance."

If we now consult the table of distances appended to French's report, we find the following:

Comanche Spring [i.e. Fort Stockton] to Leon Spring	9.57 miles
Leon Spring to Limpia[4]	37.00 miles
Limpia [i.e. the first running water] to Entrance to pass	6.97 miles
Entrance to pass to Camp in small valley	4.50 miles
Camp in small valley to Painted Camp	14.08 miles

By comparing Capt. French's running account with his table of distances, one gains the impression of an abrupt entrance into the pass, this some seven miles above the first running water, and 4.50 miles below the "camp in small valley." Is the pass itself then more than four miles long, below the little valley? Now examine the engraving facing page 84 in the first volume of Emory's Report, cited above. Here must be the "Camp in

[3]French, Capt. S. G. (Report to the Secretary of War) in Senate Exec. Doc. 64, 31st Congr., 1st Session (Serial No. 562). pp. 40–54.

[4]In his running account he says "The distance from the Ojo de Leon to the Limpia is near forty miles." The running water came (and comes) a greater or lesser distance out into the dry plain, according to the season and the recent rainfall in the mountains. Lt. Col. Johnston, whose party "directed the march" of Captain French's division and preceded it by some miles, noted in his report that the distance from Leon Spring to the Limpia ("Luripia") was 35.32 miles at the time of his passing, but stated that the first running water was sometimes to be found five or six miles nearer to Leon Spring. (Johnston, Lt. Col. J. E. [Report to the Secretary of War] in Senate Exec. Doc. 64, 31st Congr., 1st Session [Serial no. 562]. pp. 26–29).

s nall valley," labelled however "Limpia—Wild Rose Pass"—a contemporary artist's impression showing the Limpia winding down, the Army encampment, the surrounding hills. (See plate reproduced as fig. 11).

In an effort to find this "small valley," I visited the Limpia Canyon in April, 1947, and approached the supposed pass from the east, or Fort Stockton, side (i.e. from downstream). The situation is admirably shown on the topographic map published by the U. S. Geological Survey[5] (reproduced, in part, as fig. 13). As one ascends the valley ("Limpia Canyon" on the map) from east to west and northwest the mountains are ever-present but not too close on either side; one has the impression of a broad valley. Suddenly there is an abrupt change in the course of the Limpia; here it seems to emerge from the mountains, through a gap in the high hills less than a mile wide, and make a right angled turn; from flowing to the northeast it has turned east and almost southeast. As one faces up the stream on this new course the mountains seem to close in. Here, then, is Captain French's "Entrance to pass." It must have been near this point that the early parties began to feel, abruptly, the narrowing of the canyon. In actuality the valley floor continues flat, and more than a mile wide, for some three more miles upstream, to where it narrows abruptly. The modern highway leaves the Limpia (here at about 4200 feet elevation) and ascends to 4500 feet, about a mile west of the creek, to cross a "spur of the mountains" and avoid the very narrow canyon occupied by the stream. At the summit of this spur, which is really a low saddle between mountains 800–900 feet higher, the Texas Highway Department has erected a marker stating that this summit is the site of Wild Rose Pass, a pass to which the supply trains took when they were driven out of the Limpia canyon by high water. As shown by the topographic map, however, and as suggested by present-day fills and retaining walls in the canyon itself, the road traversed the canyon by the creek bed itself as late as 1894, and it seems highly improbable that the very earliest supply trains would have taken their road over this rather steep saddle now occupied by the highway, when there was no particular obstacle to their passage in the creek itself. We have, moreover, the matter of Captain French's "small valley:"

Approximately five miles from what must have been the "entrance" to the pass, if one ascends the Limpia, he reaches a point where the canyon walls narrow and rise abruptly, and the stream makes two zigzag turns, about a mile apart, to pass this deepest and steepest of all its canyons. The surrounding mountains, as shown on the map, rise almost 1000 feet above the stream, and here, at the first abrupt bend of the canyon, is a small flat floodplain valley that can be nothing but the "Wild Rose Pass" shown by the artist of the Boundary Survey; a photograph of the valley is reproduced as fig. 12, and it is evident that if we allow for discrepancies between the scene as taken in by the eye and by the camera lens, figs. 11 and 12 are very similar. The course of the Limpia is the same in the two

[5]U.S.G.S., Texas, Fort Davis Sheet, 1:125000, Edition of Mar. 1897, reprinted 1937.

Fig. 11. "Limpia— Wild Rose Pass," as seen by the artist of the Mexican Boundary Survey.

Fig. 12. A small valley in the Limpia Canyon, thought to be the same as shown in fig. 11.

figures, the rocks at the two sides are approximately alike in conformation. The engraving shows the sides of the pass relatively closer together and closer to the observer, but I take it that this may have been a result of the artist's normal visual image, which emphasizes distant objects far more than does the camera. The photograph shows a peculiarly shaped mountain on the skyline to right of center, but this would have been obscured by the columnar rocks to its right, if the camera had been placed on the slope nearer the "pass" and consequently farther to the right. I feel no hesitation in stating that figs. 11 and 12 appear to represent the same valley, and that this valley is indeed the site of Wild Rose Pass as understood by the parties of the Boundary Survey of 1849–53.

Further confirmation, if any be needed, may be gained as one ascends the Limpia from this point; nowhere else does one pass a canyon as steep and deep as that called for in the descriptions written by Parry ("the main pass, known as the '*Wild Rose Pass*,' exhibits gigantic walls of rock . . . towering up . . . 1000 feet . . .") and French ("this little valley, surrounded . . . by a wall . . . rising a thousand feet . . ."). Beside this, the distances as given by French and others check satisfactorily; as noted above, the distance from the "small valley" to Painted Camp was said to be 14.08 miles, and this is nearly enough the distance covered by the modern highway to Fort Davis,[6] which is approximately the site of the Painted Camp.

Some have supposed that Captain French's "camp in the small valley" must have been in the broad valley below the narrowest canyons shown in fig. 12; they quote him: "from here [i.e. presumably from 'this little valley'; see quotation above] the road leads over a spur of the mountains, and descends on the other side, and, continuing up the bed of the stream . . . " This has been thought to refer to the passage over the saddle where the Texas Highway marker now stands, but, as pointed out above, there would seem to have been no good reason for such an ascent with heavily loaded wagons, and I think his words must refer rather to some lower hill

[6]The "Painted Comanche camp" is well located in the report of Lt. Wm. F. Smith, who went over this same route in the spring of 1849. (Report to the Secretary of War) in Senate Exec. Doc. 64, 31st Congr., 1st Session (Serial no. 562). pp. 4–7. Smith mentions the Limpia (which he does not call by name) and says: "This creek is followed for a distance of about twenty-five miles to the Painted Comanche camp; and here the road to Presidio del Norte passes to the southward and westward, while the road to El Paso del Norte strikes northwestward towards the pass in the mountains on the Rio Grande, striking that river about ninety-five miles above Presidio del Norte. The road from this camp may either follow the creek [i.e. the Limpia] to its head, passing through the mountains there, or, by leaving the mountains, directly pass along parallel to their western slope, thus obtaining a road with less labor and less water." A camp from which travellers could ascend the Limpia further, or could alternatively follow the level plain to the southwestward, must have been almost where the modern highway from the south first approaches the Limpia, not far from the site of the now abandoned military post of Ft. Davis, and about a mile below the present center of town, where the Limpia emerges onto the high plain from a relatively narrow canyon to the westward.

Fig. 13. Part of the Fort Davis Sheet, U.S. Geological Survey. The arrows (reading from top to bottom) point out (1) The "entrance to the pass;" (2) The site of Wild Rose Pass as stated by the highway marker (approximate course of modern highway shown by broken line); (3) The "small valley" shown in fig. 12 and apparently also in fig. 11. This is the actual site of Wild Rose Pass as indicated by the present study.

that was crossed to save distance by cutting off one of the many bends in the crooked course of the Limpia.

Finally, aside from the geographical location of the place, there is the matter of the name itself: Wild Rose Pass. At the present time no wild roses (genus *Rosa*) are known to me from this part of Texas, although they do occur at higher elevations in the Davis Mountains. Gray (Pl. Wright. 1:68) cited Wright's no. 185, *Rosa blanda* Ait. β, as having been collected "along the Limpia." Now, however, if there are any roses at all in the lower Limpia Canyon, which I doubt, there are surely not enough of them to give a distinctive name to the pass. It is of course possible that overgrazing and its consequences, including increasing aridity and erosion, have eliminated the true wild roses from an area in which they were abundant in 1849. It has been suggested, however, that the source of the name is an entirely different plant of the rose family, *Fallugia paradoxa* (Don) Endl., which is common today in the Limpia valley and whose flowers, abundantly produced, resemble those of rather small single white roses.

Herbarium, University of Michigan
Ann Arbor, Michigan

CURLY MESQUITE GRASS IN TEXAS AND NORTHERN MEXICO

V. L. Cory

During 1924–1926 I made detailed vegetation surveys covering more than one hundred acres in six pastures of the Ranch Experiment Station (Substation No. 14, Texas Agricultural Experiment Station) located centrally on the Edwards Plateau in the counties of Edwards and Sutton. This was done by means of selected rectangular areas broken down for purposes of counting and mapping into checkerboards of one square rod. The number of individuals of each of the woody species, including cacti, was ascertained, and the amount of ground-space occupied by each was computed or closely estimated. Among the herbaceous plants, any significant occurrence of the perennial forbs was accorded a count, while only an estimate was made of the area occupied by the important perennial grasses. Hence some twenty years ago it was found that curly mesquite grass, *Hilaria Belangeri* (Steud.) Nash, comprised about 85% of the stand of grass on this range of five sections. Range studies in these and subsequent years provided me with excellent opportunities to become quite familiar with this, our most important range grass. Here in southern Sutton and northern Edwards counties it grows in essentially pure stands and occupies all the ground in which it is peculiarly adapted; but it does not grow in the area of submergence in lake-beds that become lakes at times of abundant rainfall, in oak thickets, or on the open stony slopes and ridges. When the white man took over this area of country it was a prairie of tall bunch grasses. Four or five decades later, as the result of continuous and excessive grazing of cattle, sheep, and goats the country became timbered and the palatable bunch grasses disappeared and were superseded by the two turf grasses, curly mesquite and buffalo grass. It was known in the early 'twenties that significant changes in the herbaceous vegetation of the higher and dryer Trans-Pecos grasslands had already taken place, or were in the process of doing so.

A general vegetation survey of the Trans-Pecos area of Texas was made in the years 1927–28. While engaged on this survey I observed and collected a curly mesquite grass in a broad valley of the Marfa Plateau northeast of Marfa on July 24, 1928. I recognized immediately that this was not the same species as the one with which I already was familiar. Here the curly mesquite was growing at an elevation two thousand feet or more greater than on the Edwards Plateau. It grew sparingly, instead of in extensive pure stands, and appeared to have stolons with much shorter internodes, thereby causing the formation of a denser turf and making more abundant foliage. Moreover its inflorescence was characterized by the glumes being

invested densely with black glands; such glands are extremely rare on *H. Belangeri*, and when present they are not abundant and are transitory in nature. Being without library and herbarium facilities, and to express my belief that this plant was not *H. Belangeri*, I labeled this collection *H. cenchroides* H.B.K., a species known to me only as one that grew in Mexico, hence conceivable of possible occurrence also in southwestern Texas. At that time I had not seen a description of *H. cenchroides*, so it seemed probable that my guess might be a good one. However, when this material was sent to an eastern herbarium, the report was that it could not be *H. cenchroides*, which was confined to Mexico, but that it should be referred to *H. Belangeri*, a species apparently confined to Texas. While the first part of this report was acceptable to me the second part was not.

Before taking ample material of this grass I took fragmentary specimens at two other localities. The fourth locality at which I saw and collected this new grass was fourteen miles southwest of Marfa. On June 26, 1937, while I was with a caravan of workers and ranchmen interested in range maintenance and improvement, at one of the stops some of the party found the curly mesquite and brought it to me, and expressed their belief that it was different from the species of the Edwards Plateau. This, the first support of my belief, encouraged me to make a fuller collection here (no. 34816), and on my return to headquarters to collect *H. Belangeri* (no. 34888). This species was not then in head on the range, but was found so in yards where its growth was under more favorable conditions. Both of these collections were sent to Mr. Jason R. Swallen with a letter stating that I believed these plants were specifically distinct. I also asked him to check the specimens with material available to him and to compare both with the type specimen of *H. Belangeri*.[1] Since the type was in the Gray Herbarium, there was some delay before Mr. Swallen informed me that he could agree with my contention. He also stated his intention to describe the new species, but his duties delayed him from doing so. Recently in correspondence Mr. Swallen suggested that I should go ahead and describe the grass myself. Inasmuch as my material was no longer available to me, Mr. Swallen courteously loaned me twenty-one sheets. It seems fitting, therefore, that the new species should be named in his honor.

Hilaria Swalleni sp. nov. Planta perennis, stolonifera, internodis 2–12 cm. longis. Caulibus simplicibus, erectis, plerumque minus quam 1.5 dm. altis, nodis barbatis. Foliis basalibus, 1–2 mm. latis, 1 dm. longis vel minus. Spicis 3–5 cm. longis, laxifloris, cum 3–7 racheis spiculiferus; racheis 7–8 mm. longis, 5 mm. latis. Glumis nervis prominentibus scabris interdum excurrentibus, dense atroglandulosis. Lemmate et palea hyalinus plus minusve purpurascentibus.

Plant perennial, stoloniferous, the internodes 2–12 cm. long. Stems simple, erect, usually less than 1.5 dm. tall, the nodes bearded. Leaves

[1]Cited by Steudel: "Mexico, Belanger 1428." This is evidently in error for "Mexico, Berlandier 1428," which agrees in description and was collected between Laredo and Bejar (Bexar), now Texas. Belanger collected in India.

chiefly basal, 1–2 mm. broad and 1 dm. long or less. Spikes 3–5 cm. long, rather loosely flowered, with 3–7 clusters of spikelets; spikelet clusters 7–8 mm. long and 5 mm. broad. Glumes scabrous on prominent nerves which may or may not project as short black awns and thickly beset with permanent black glands. Lemma and palea hyaline more or less tinged with purple.

Six or more sheets of each of three species of curly mesquite grass were obtained through Mr. Swallen from the United States National Herbarium, and none of these was from my own collections. Seven of these sheets should be referred to the new species.

TEXAS: Brewster Co., Alpine, September 13, 1915. *A. S. Hitchcock 13168.* Jeff Davis Co., Davis Mountains (presumably Jeff Davis Co.), August 13, 1914, *Mary S. Young 46;* Musquiz Canyon, July 28, 1938, *Omer E. Sperry T778.* Presidio Co., prairies west of Marfa, September, 1883, *V. Havard 15;* prairies about Marfa, October, 1883, *V. Havard 15;* dry rocky plains near Marfa, June 18, 1926, *E. J. Palmer 31075.* MEXICO: Coahuila, 3 miles southeast of Saltillo, August 31, 1938, *I. M. Johnston 7251.*

As a tribute to my friend, Dr. Omer E. Sperry, for the excellence of the material, *Sperry T778*, is designated as the type specimen. It is deposited in the United States National Herbarium.

The Havard collections were labeled "*Hilaria cenchroides* H.B.K. var. *texana* Vasey" and the others (with the exception of the Johnston collection) were labeled "*Hilaria Belangeri* (Steud.) Nash." *Johnston 7251* was labeled "*Hilaria cenchroides* H.B.K. An explanation of Johnston's viewpoint was found in his report published in the Journal of the Arnold Arboretum vol. xxiv, 1943, wherein the same collection is reported as *H. Belangeri*, this making all the pertinent material before me definitely referred to that species. In this report Johnston comments, "The present northern plant is very closely related to *H. Cenchroides* H.B.K. of central Mexico, and is perhaps not specifically distinct." In this connection he cites two collections from Chihuahua, one of which, *Pringle 4931* was included in the listing of collections of *H. cenchroides* by Hitchcock in "Mexican Grasses in the United States National Herbarium, Contr. U. S. Natl. Herb., vol. 17, pt. 3, 1913. Thus this specimen also is to be referred to our new species. Since Johnston reports this grass as common where he collected it in northern Mexico and it has not been found that way in southwestern Texas it appears probable that it is more at home in Mexico than it is in Texas.

KEY TO THE SPECIES OF CURLY MESQUITE

1. Foliage relatively abundant, the leaf-blades up to 4 mm. broad; spike densely flowered, appearing purplish; spikelet-clusters 8–12, about 6 mm. long and 4.5–5 mm. broad; glumes relatively short and broad, the broad margins deeply purple, not densely glandular with brownish to purplish glands, the nerves evident but not prominent, sparsely excurrent as short pale awns. Known from central Mexico south into Guatamala .... *H. cenchroides.*

1. Foliage less abundant, the leaf-blades 2 mm. broad or less; spike loosely flowered, appearing either pale or black; spikelet-clusters 3–7, 5–8 mm. long and 2–5 mm. broad; glumes longer and narrower, the narrower hyaline margins not deeply purple, either without glands or these black..... 2.

   2. Spike appearing pale; spikelet-clusters 5–6 mm. long and 2–3 mm. broad; glumes with narrow hyaline margins not tinged with purple, without or rarely with vestiges of black glands, nerves evident but not prominent, more frequently excurrent as short awns, these pale and somewhat longer. Known from the Edwards Plateau, the Rio Grande Plains, and sporadically from the Rolling Plains of Texas ..... *H. Belangeri.*

   2. Spike appearing black; spikelet-clusters 7–8 mm. long and about 5 mm. broad; glumes with hyaline margins usually tinged with purple, densely beset with black glands, the 3–4 nerves prominent, excurrent on some spikelets as short black awns. Known from the higher elevations of southwestern Texas (Brewster, Jeff Davis, and Presidio counties) and of northern Mexico (Chihuahua and Coahuila)..... ..... *H. Swalleni.*

Attention is called to the fact that, on the range, *H. Belangeri* rarely produces viable seed. Its reproduction and spread on the Edwards Plateau are chiefly due to its habit of forming new plants by rooting at the nodes of the stolons.

In contrast to curly mesquite, buffalo grass reproduces by seed as well as vegetatively. In consequence buffalo grass forms a much denser turf. From observations and from counts of plants in hundreds of meter quadrats it is known that the density of curly mesquite rarely exceeds 35% of the ground cover, whereas, buffalo grass at its best, reaches 100%. In our counts in turf of pure stands of each the number of plants were twice to thrice as great for buffalo grass as for curly mesquite.

Until in recent years ranchmen did not distingiush curly mesquite from buffalo grass, referring to both as mesquite grass. Some ranchmen, having the coarse bunch grass properly known as tobosa grass, *Hilaria mutica* (Buckl.) Benth., on their ranges were accustomed to refer to it as buffalo grass; unfortunately they never had had the opportunity of observing the grazing habits of buffaloes. However, their livestock habitually grazed to the ground the islands of buffalo grass in the sea of curly mesquite. Thus on overgrazed ranges the spots of buffalo grass tend to become killed out, while curly mesquite grass tends to increase in abundance. In severe overgrazing both turf grasses decrease in abundance and are supplanted by forbs, either worthless for forage or poisonous to livestock. Destruction of the grasses favors the encroachment of woody plants and cacti, and reduces the value of the range accordingly, at the extreme, even to an approach to zero. As a good forage plant, may curly mesquite grass increase in abundance on those ranges where other good or better grasses cannot compete successfully with it!

A NEW SPECIES OF CHRYSOPSIS NUTTALL FROM THE DRIFTLESS AREA OF WISCONSIN

LLOYD H. SHINNERS

Chrysopsis wisconsinensis Shinners, sp. nov.—Perennis humilis multicaulis 18–35 cm. alta, parte quarta terminali corymboso-ramosa, erecta vel basi interdum curvata, dense duplice hispido-pilosa, pubescentia pansa (pilis longioribus 1–2 mm. longis, brevioribus tenuioribusque 0.2 mm. vel minus). Folia caulina 15–20 infra inflorescentiam, oblanceolata subpetiolata hispido-pilosa, media 2.2–3.7 cm. longa 0.6–0.8 cm. lata basi petiolari 0.3–1.5 cm. longa. Capitula bracteata ramulos 1.5–6.0 cm. longos terminantia. Involucra 8–10 mm. alta, phyllariis imbricatis hispido-pilosis 0.6–1.2 mm. latis. Receptaculum florens 4–6 mm. latum. Flores radiati 18–25, ligulis oblongis, oblongo-lanceolatis, seu oblongo-ellipticis, 6–8 mm. longis 1.0–2.2 mm. latis. Achaenia 2.7–4.0 mm. longa subappresse villosa. Pappus interior e setis multis barbellatis 5.0–6.2 mm. longis, exterior e setis paucis ad 1 mm. longis constitutus.

Perennial from a taproot; caudex producing numerous stems 18–35 cm. tall, branching corymbosely in the terminal quarter, erect or nearly so, sometimes curved near base, densely hispid-pilose with double pubescence; coarse, whitish, jointed, translucent hairs 1.0–2.0 mm. long, and rather fine hairs 0.2 mm. or less long, all spreading at right angles from the stem. Stem leaves 15–20 below the inflorescence, the lower soon withering but rather persistent, oblanceolate, tapered into a narrow petiole-like base, clothed with long, more or less spreading hairs like the longer ones of the stem. Blades of middle stem leaves 2.2–3.7 cm. long by 0.6–0.8 cm. wide, the petiolar base 0.3–1.5 cm. long. Leafy bracts of the inflorescence sessile or subsessile, 1.3–2.3 cm. long. Heads terminating short branches which elongate during and after flowering, the majority ultimately 1.5–6.0 cm. long, leafy-bracted, the uppermost bract usually within 3–15 mm. of the head, or sometimes one or two of the outermost phyllaries slightly foliaceous and transitional to the peduncular bracts. Involucres 8–10 mm. high; phyllaries irregularly imbricated, the outermost ⅓–½ as long as the innermost, acute or subacuminate, granulose and densely hispid-pilose with long, white, spreading hairs, green, turning brown, with scarious margins; middle and inner about 0.6–1.2 mm. wide, keeled-ribbed for ⅔–¾ their length, all becoming reflexed in fruit. Receptacle 4–6 mm. across in flower. Ray florets 18–25; ligules 6–8 mm. long, 1.0–2.2 mm. wide, oblong to oblong-lanceolate or oblong-elliptic, obtuse; tube about 4 mm. long. Disk florets 120 (one count), tubular, subcylindrical, slightly expanded toward summit, about 5 mm. long, the lobes 0.6–0.7 mm. long. Achenes 2.7–4.0 mm. long, villous with subappressed hairs. Pappus of

numerous, creamy to tawny, minutely barbellate bristles 5.0–6.2 mm. long, and an irregular outer ring of few short bristles not over 1 mm. long.

The type was collected on an exposed sandy slope 14 miles north of Wisconsin Dells in Adams County, Wisconsin, *H. C. Greene*, July 7, 1947 (in herb. Southern Methodist University; isotypes at Gray Herbarium, University of Illinois, Milwaukee Public Museum, and University of Wisconsin). Additional specimens examined:

WISCONSIN: Adams Co., 13 miles n. of Wisconsin Dells, T. 16 N., R. 6 E., sec. 36 *J. W. Thomson*, August 18, 1937 (mostly past fruiting; only two late flowering heads present); 12.8 miles n. of State Highway 135 on County Trunk B, n.e. of Wisconsin Dells, *J. J. Davis & N. C. Fassett 16938*, June 13, 1934; T. 16 N., R. 7 E., sec. 30, s.w. 1/4, *L. H. Shinners 4314*, June 28, 1942 (all in herb. University of Wisconsin).

Chrysopsis wisconsinensis is a dwarf spring-flowering plant of alkaline sandy soil in the Driftless Area in central Wisconsin. The type locality is almost exactly the same as that of another less restricted endemic, *Panicum euchlamydeum* Shinners. All the cited collections were made in the same general area, in which the plant is locally very common and even weedy. A second *Chrysopsis*, *C. Ballardii* Rydb. perhaps not specifically separable from *C. hispida* Hook., enters Wisconsin from the west along the St. Croix River. It is a more robust plant than *C. wisconsinensis*, the stems as much as twice as tall, branching lower and less freely, with somewhat shorter stem hairs (about 2/3 as long as in *C. wisconsinensis*), and a larger receptacle (6–9 mm. across in flower). Its main flowering time is from July to September, instead of June to early July as in *C. wisconsinensis*.

ADDITIONAL NOTES ON THE ERIOCAULACEAE, AVICENNIACEAE AND VERBENACEAE OF TEXAS—I[1]

HAROLD N. MOLDENKE

Since I prepared my discussion of the ERIOCAULACEAE, AVICENNIACEAE, and VERBENACEAE for the *Flora of Texas* [vol. 3, part 1, pp. 1–87. 1942] 1939 additional herbarium specimens of these groups, collected in Texas, have come to my hands. Some of these were reported in *Phytologia*, vol. 2, pp. 123 128 (1945) and 152 168 (1946), but it has been thought advisable to list all in the present paper so that the records would all be available in one place to students of the flora of Texas. These 1939 additional specimens have brought to light 275 new county records and eleven additions to the flora of the state. In addition, it has been found that three names employed in the *Flora of Texas* will have to be abandoned, two of them must be replaced by others. The status of one "species" listed as doubtful in the *Flora of Texas* has been settled, and in at least two cases where no actual herbarium material had hitherto been seen to substantiate records of species' occurrence in Texas as given in previous literature, specimens have now come and the records are therefore authenticated. The labels on these additional specimens have also given a large amount of new information about the growth and habit of the plants, the color of the flowers or fruit, their habitat, common names, etc. This additional information is given in the present paper under the species involved. It must be clearly understood that this information is *supplementary* to that given in the *Flora of Texas*. In a few cases previous misidentifications have had to be corrected and the keys modified.

[1]The specimens cited in the present paper are deposited in the herbaria indicated by the following abbreviations: Al = New York State Museum, Albany; Au = University of Texas, Austin; Br = Jardin Botanique de l'Etat, Brussels; Bt = Butler University, Indianapolis; C = Columbia University Herbarium, New York Botanical Garden, New York City; Ca = University of California, Berkeley; Cm = Carnegie Museum, Pittsburgh; Cn = University of Cincinnati, Cincinnati; Du = Dudley Herbarium, Stanford University, California; Fc = Colorado Agricultural & Mechanical College, Fort Collins; Ga = Georgia Agricultural Experiment Station, Experiment, Georgia; Go = Botaniska Trädgard, Göteborg, Sweden; H = Duke University, Durham, North Carolina; Hp = H. Hapeman Herbarium, Minden, Nebraska; Hs = Crispus Attucks High School, Indianapolis; I = Langlois Herbarium, Catholic University of America, Washington; It = Cornell University, Ithaca, New York; Ka = Kansas State College, Manhattan; Kr = B. A. Krukoff Herbarium, New York Botanical Garden, New York City; Ky = University of Kentucky, Lexington; Ld = Lundell Herbarium, Dallas; Ll = Lloyd Library, Cincinnati; Me = Instituto de Biologia, Universidad Nacional de México, Mexico City; Mi = University of Michigan, Ann Arbor; Ml = Instituto Miguel Lillo, Tucumán, Argentina; N = Britton Herbarium, New York Botanical Garden, New York City; Ok = University of Oklahoma, Norman; Pl = State College of Washington, Pullman; Po = Pomona College, Claremont, California; Pr = Princeton University Herba-

rium, New York Botanical Garden, New York City; Se = University of Washington, Seattle; Si = Instituto Darwinion, San Isidro, Argentina; Sm = Southern Methodist University, Dallas; St = Oklahoma Agricultural & Mechanical College, Stillwater; T = Torrey Herbarium, New York Botanical Garden, New York City; Tr = S. M. Tracy Herbarium, Texas Agricultural Experiment Station, College Station; Up = University of Pennsylvania, Philadelphia; Ur = University of Illinois, Urbana; Va = Vanderbilt University, Nashville, Tennessee; Vt = University of Vermont, Burlington; W = United States National Herbarium, Smithsonian Institution, Washington; We = West Virginia University, Morgantown; and Z = H. N. Moldenke Herbarium, Watchung, New Jersey. I am deeply grateful to the directors and curators of these herbaria for permitting me to study and annotate their material of these groups.

ERIOCAULACEAE Lindl.

ERIOCAULON DECANGULARE L.

Anderson Co., *LeSueur & Smith s.n.* [7/7/35] (Au, N), *s.n.* [7/7/38] (Au). Austin Co., *Tharp 44347* (N), *44348a* (N), *s.n.* [6/28/42] (Al, Au). Freestone Co., *G. W. Goldsmith s.n.* [6/15/41] (Au, Au). Hardin Co., *Tharp s.n.* [July 20, 1929] (Au, Au), *s.n.* [7–21–42] (Au). Henderson Co., *Tharp 2280* (Au). Jasper Co., *G. L. Fisher 32101* (Au, Au). Jefferson Co., *Mrs. Smith s.n.* [Beaumont, July '15] (Au). Newton Co., *Tharp 44342* (Au, N). Robertson Co., *F. A. Barkley 1340* (Al), *13034* (N). Rusk Co., *Vinzent 47* (Br). Smith Co., *J. Reverchon 2766* (Po), *4359a* (Po). Tyler Co., *Tharp 44345* (Au, N). Waller Co., *E. Hall 675* (Po, Ur).

ERIOCAULON COMPRESSUM Lam.

Hardin Co., *E. J. Palmer 9563* (Du); *Tharp s.n.* [July 20, 1929] (Au). Jefferson Co., *Hooks s.n.* [Beaumont, 5/3/1930] (Au, N), *s.n.* [Beaumont, 5/30/34] (Au).

ERIOCAULON TEXENSE Körn.

Austin Co., *Tharp s.n.* [5/4/40] (Au); *Warnock 224* (N). Leon Co., *F. A. Barkley 13556* (N). Milam Co., *Tharp 4434c* (Au, N), *44344* (N), *44344b* (N, N). Robertson Co., *F. A. Barkley 13543* (N); *Painter & Barkley 13540* (N).

ERIOCAULON KÖRNICKIANUM Van Heurck & Müll.-Arg.

Polk Co., *Tharp 42–6* (N), *42–7* (N, N).

LACHNOCAULON ANCEPS (Walt.) Morong.

Jasper Co., *Whitehouse s.n.* [6/10/1931] (Au, Au, N). Jefferson Co., *Hooks s.n.* [5/30/34] (Au), *s.n.* [6 7 36] (Au). Newton Co., *Tharp 44346* (Au, N). Tyler Co., *Tharp 44343* (Au, N).

AVICENNIACEAE Endl.

AVICENNIA NITIDA Jacq.

An additional vernacular name for this species, reported by Runyon from Texas, is "mangle negro." The species has been found in salt marshes as well as in the habitats listed in the *Flora of Texas*.

Cameron Co., *Muenscher & Winne 15577* (It); *Parks 1724* (Au); *R. Runyon 2077* (N), *4031* (Au). Nueces Co., *Tharp s.n.* [Port Aransas, 7 2 30] (Va). *s.n.* [July 2, 1939] (Au).

VERBENACEAE J. St. Hil.

VERBENA RIGIDA Spreng.

The species is described as a perennial, inhabiting the coastal prairie, blossoming in April.

Brazoria Co., *Tharp s.n.* [7/2/39] (Sm). Galveston Co., *Mrs. A. F. Nelson s.n.* [4/20/42] (Au, Sm); *E. C. Smith s.n.* [Dickinson Bayou, 5-2-1942] (Fc). Harris Co., *C. C. Albers 35004* (Au); *G. L. Fisher s.n.* [Houston, Sept. 14, 1913] (Hp), *s.n.* [Houston, Apr. 11, 1930] (Bt), *s.n.* [Sept. 10, 1932] (Du, I). Jefferson Co., *Lundell & Lundell 11206* (N). Shelby Co., *Lundell & Lundell 10502* (Ld). Travis Co., *Tharp s.n.* [Austin, 5/2/35] (Bt, St). County undetermined, *C. C. Albers 39008* (Au, Au).

VERBENA BONARIENSIS L.

The species is described as being infrequent in sandy woods.

Galveston Co., *Mrs. A. F. Nelson s.n.* [5-5-42] (Au). Harris Co., *Boon 60* (Au); *G. L. Fisher 34094* (Au). Jasper Co., *Cory 49850* (Sm). Tyler Co., *C. C. Albers 39011* (Au).

VERBENA BRASILIENSIS Vell.

This species has not hitherto been reported from Texas. It may be distinguished from *V. bonariensis* by its leaves being cuneate-attenuate to the sessile or subpetiolar base, instead of being cordate or amplexicaul as in *V. bonariensis*. It is described from Texas as growing 3–4 feet tall, with lavender-blue or purplish corollas, blooming in July. It has been found along roadsides, in pinelands, on coastal prairies, and abundant in black soil. It is a native of tropical America.

Hardin Co., *C. L. Lundell 14083* (N). Jefferson Co., *C. L. Lundell 14136* (N). Orange Co., *Cory 50840* (Sm). Wharton Co., *Warnock 46420* (Au, N.)

VERBENA HALEI Small.

Collectors describe the plants as branched at the base, the branches erect, 14 inches to 4 feet tall, annual or perennial herb, with lavender or pinkish-lavender corollas. Collectors have found it growing in sand and shell, rocky open ground, gravelly soil, rocky banks, red sandy or black soil, wet soggy places, mesquite woods, red sandy clay, open or mesquite prairies, in dry sandy soil along railroad tracks, in deep sand in low places on prairies, in shade of trees in old river-beds, and "infrequent" on highway shoulders.

In regard to *Lindheimer 155*, in part, cited by me on page 22 of my discussion of this family in the *Flora of Texas* as possibly from Palo Pinto County, Dr. S. W. Geiser thinks that Lindheimer never collected in Palo Pinto County. The specimen may have come from some other county—its label states merely "Dry prairies on the Brazos, July and August, 1843."

Anderson Co., *K. E. Smith s.n.* [Palestine, 4/21/35] (Bt, St). Aransas Co., *Cory 49034* (Sm). Archer Co., *Whitehouse 9721* (N). Bastrop Co., *Lundell & Lundell 10344* (Ld); *Warnock 46283* (Au), *46284* (Au, N). Bee Co., *F. A. Barkley 16T421* (Au, N). Bell Co., *Cohn T.11* (Au); *Cohn & Barkley T.44* (Au); *Wolff 2948* (Tr), *3491* (Tr), *3718* (Tr). Bexar Co., *Headley s.n.* [March

24, 1907] (I); *G. Jermy 88* (W); *Metz 62* (I), *75* (I), *3240* (Au); *E. D. Schulz 766* (I); *Texas Agr. Exp. Sta. Herb. Exchange 3495* (Hp). Bowie Co., *Correll & Correll 12421* (Sm). Brazos Co., *Chenault s.n.* [April 12, 1937] (N); *Cory 50627* (Sm); *Lake s.n.* [May, 1890] (Pr); *J. N. Weaver 490* (Ld). Brewster Co., *Warnock 583* (Au). Brooks Co., *C. L. Lundell 10811* (Sm). Burnet Co., *Rose-Innes & Warnock 798* (Au). Calhoun Co., *H. Gentry 29* (Au, N). Cameron Co., *L. I. Davis s.n.* [Palm Grove, Summer '41] (Au, Sm); *C. L. Lundell 10689* (N); *Lundell & Lundell 8623* (Ld); *R. Runyon s.n.* [Brownsville, 1930] (Hp). Cherokee Co., *F. A. Barkley 13585* (Au). Coleman Co., *Warnock 46341* (Au, N). Colorado Co., *Warnock 46430* (Au, N), *46432* (Au). Comal Co., *Lindheimer 537* (Ka), *1076* (Br, Me, Me, Me). Culberson Co., *Cory 53037* (N); *U. T. Waterfall 4496* (N). Dallas Co., *Lundell & Lundell 8346* (Ld), *8578* (Ld), *10398* (Ld), *12107* (N); *Shinners 8505* (Sm); *Wilfong 82* (Sm). Denton Co., *McCart 2006* (Au, St); *Whitehouse 15785* (Sm). De Witt Co., *M. Riedel s.n.* [9–26–41] (Au). Duval Co., *Croft 119* (Ga). Fayette Co., *Barkley, Warnock, & Tharp 46350* (Au, N); *Parks & Cory 10072* (Tr); *Warnock 46285* (N), *46287* (Au, N) *46436* (Au, N). Frio Co., *Lundell & Lundell 10139* (Ld); *Wolcott & Barkley 16T265* (Au, N). Galveston Co., *Cory 51017* (Sm); *R. L. Crockett s.n.* [Apr. 22, 1944] (Au); *Dapprich 7764*, in part (Sm); *G. L. Fisher s.n.* [Galveston, June 6, 1920] (H); *Tracy 7533* (Cm). Goliad Co., *Lundell & Lundell 10060* (Ld). Gonzales Co., *C. G. Ward 288* (St). Gregg Co., *C. L. York s.n.* [Fall, 1937] (Au), *s.n.* [4–2–38] (Au). Grimes Co., *Harding 579* (St); *T. V. Weaver 1038* (Ml, N). Harris Co., *L. Anderson s.n.* [Sept.–Oct. 1936] (Au); *Boon 62* (Au), *290* (Au, N); *G. L. Fisher s.n.* [Houston, Apr. 23, 1914] (Hp), *s.n.* [Houston, Apr. 9, 1931] (Bt, Du, St); *E. Hall 432* (Pr); *Rose-Innes & Warnock 673* (Au). Hidalgo Co., *Painter & Barkley 14428* (Au, N). Jackson Co., *Tharp & Barkley 13A114* (Au, Ml, N, N). Jasper Co., *Lundell & Lundell 10513* (Ld). Jefferson Co., *C. L. Lundell 11250* (Sm). Jim Wells Co., *Lundell & Lundell 10076* (Ld); *Muenscher & Muenscher 14391* (N); *Wagner & Barkley 16T320* (Au, N), *16T321* (Au, N). Kaufman Co., *Lundell & Lundell 8506* (Ld). Kenedy Co., *Lundell & Lundell 10728* (N), *10844* (Ld), *10847* (N); *Wagner & Barkley 16T392* (Au, N), *16T393* (Au, N). Kerr Co., *E. J. Palmer 10037* (Du). Kleberg Co., *Cory 51322* (Sm); *J. F. Sinclair s.n.* [Kingsville, Summer, 1940] (Au). La Salle Co., *Lundell & Lundell 10143* (Ld). Leon Co., *Lundell & Lundell 10391* (Ld); *E. C. Smith s.n.* [Oakwood, 5–4–1942] (Fe). Llano Co., *Lundell & Lundell 9040* (Ld); *Wolff 3067* (Tr, Tr), *3825* (Tr). Matagorda Co., *Cory 51091* (Sm); *Warnock 46308* (Au, N), *46312* (Au, N). McLennan Co., *C. L. York 46087*, in part (Au), *46100*, in part (N). Milam Co., *Lundell & Lundell 10374* (Ld). Montague Co., *McCart 1634* (Au). Navarro Co., *Cory 51533* (Sm). Nueces Co., *Tracy s.n.* [Corpus Christi, 3–31–1905] (Tr); *Warnock 20999* (Au). Palo Pinto Co., *J. W. Gillespie 5214* (Du). Pecos Co., *Warnock 46166* (Au). Polk Co., *Girvin s.n.* [April 12, 1940] (Au, Au); *Tharp s.n.* [4–12–42] (Au). Reeves Co., *U. T. Waterfall 4388* (N). Refugio Co., *Lundell & Lundell 10856* (N); *E. J. Palmer 9111* (Du). San Augustine Co., *E. J. Palmer 9485* (Du). San Patricio Co., *Cory 51259* (Sm); *Wolcott & Barkley 16T405* (Au, N). Starr Co., *Lundell & Lundell 9924* (Ld). Tarrant Co., *F. C. Gates 19133* (Ka); *Lundell & Lundell 8522* (Ld); *Ruth 84* (Au), *93* (Ll), *108* (Cm, Ka), *s.n.* [Fort Worth, June 5, 1909] (Po). Taylor Co., *Tracy 7996* (Cm, N, Vt). Travis Co., *C. C. Albers 33016* (Au); *Armer 5385* (Au); *Cohn & Barkley 13253* (Au); *Lundell & Lundell 10308* (Ld); *Tharp 1529* (Au), *s.n.* [Austin, 4/23/29] (Au, Pl), *s.n.* [Austin, 5/2/35] (Au, Bt, St), *s.n.* [Austin, 5/9/35] (Au, St); *Warnock 45–5* (Au), *46104* (Au); *Wheeler, Buck, & Barkley 16T248*

(Au, N); *M. S. Young 77* (Au), *s.n.* [4/5/18] (Au). Uvalde Co., *M. E. Jones s.n.* [April 26, 1931] (Du); *C. L. Lundell 10965* (N). Val Verde Co., *M. E. Jones 26229* (I). Walker Co., *Tharp s.n.* [6/11/35] (Sm). Waller Co., *Dooley 2* (Au, N). Washington Co., *C. C. Albers 33017*, in part (Au); *Brackett 253* [March 29, 1938] (Au), *s.n.* [April 21, 1939] (Au). Webb Co., *Perkins & Hall 2627*, in part (Po). Wharton Co., *Warnock 46421* (Au, N). Wichita Co., *Ferris & Duncan 3337* (Du); *Whitehouse 10474* (N). Willacy Co., *Cory* 51489 (Sm); *Lundell & Lundell* 8786 (Ld). Young Co., *Whitehouse 15324* (N).

VERBENA SCABRA Vahl.

Collectors have reported the color of the corolla of this species as lavender, and have found the plant in Texas in low woods and wet pine barrens.

Bexar Co., *Lindheimer 618* (Ka), *1077* (Br, Me, Ok, Up); *Metz 782* (I). Gonzales Co., *Tharp & Barkley 13850* (Au). Hardin Co., *C. L. Lundell 14079* (Ld). Jefferson Co., *E. J. Palmer 10692* (Du). Kerr Co., *G. L. Fisher s.n.* [Kerrville, Aug. 27, 1932] (Bt). Kimble Co., *Strandtmann s.n.* [Aug. 19, 1941] (Au). Liberty Co., *E. J. Palmer 8557* (W). Real Co., *Cory 39708* (Au), *39709* (N), *42774* (Au). Travis Co., *C. C. Albers 40004* (Au); *F. A. Barkley 13366* (Au); *Strandtmann s.n.* [Aug. 1, 1940] (Au); *Tharp s.n.* [Austin, 7–18–41] (Sm). Val Verde Co., *Cory 38068* (Au), *38069* (N). Walker Co., *C. C. Albers 39010* (Au). County undetermined, *Lindheimer s.n.* [1850] (Ka).

VERBENA URTICIFOLIA L.

Texan collectors describe the species as a coarse annual, and have found it in alluvial sandy soil, old gravel roads, woodlands, wooded ravines, and shady places.

Dallas Co., *C. L. Lundell 11581* (N), *14022* (N). Denton Co., *Whitehouse 16426* (N). Tarrant Co., *Ruth 504* (Cm), *534* (Sm). Wise Co., *Whitehouse 16374* (N).

VERBENA URTICIFOLIA var. LEIOCARPA Perry & Fernald.

This variety, not reported previously from Texas, may be distinguished from the typical form of the species by the under surface of its leaves being densely short-pubescent or velutinous, the individual hairs to 0.3 mm. long, the mature inflorescence-branches usually being filiform, loosely ascending or divergent, and puberulent, the mature calyx being to 2 mm. long and puberulent, the bractlets being 0.5–1 mm. long, and the nutlets about 1.5 mm. long and smooth. In the typical form of the species the under surface of the leaves is glabrous or more or less pubescent with elongated whitish hairs 1–1.3 mm. long, the mature inflorescence-branches are usually stiffly ascending and strigose, the mature calyx is strigose and 2–2.3 mm. long, the bractlets are 1–1.5 mm. long, and the nutlets are 2 mm. long, corrugated or ribbed on the back.

The variety has been found in shade in low marshy land in Cass County, the only record so far from the state.

Cass Co., *Whitehouse 17697* (Sm).

VERBENA HASTATA L.

The species has been found in Texas in river bottoms.

Hemphill Co., *Cory 50298* (Sm). Oldham Co., *Ferris & Duncan 3513* (Du).

VERBENA STRICTA Vent.

Cook Co., *Strandtmann s.n.* [July 26, 1941] (Au). Dallas Co., *Mrs. J. P. Stephenson s.n.* [Ennis, May 6, 1928] (Ld). Hemphill Co., *Cory 50269* (Sm). Tarrant Co., *Ruth 162* (Ll), *s.n.* [Fort Worth, Aug. 27, 1909] (Po).

VERBENA MACDOUGALII Heller.

Culberson Co., *Grassl 175* (I).

VERBENA XUTHA Lehm.

Several photographs of the type collection of *Verbena Matthesii* Turcz. have become available since the writing of my discussion of the family in the *Flora of Texas*. It can now be stated definitely that *V. Matthesii* Turcz. is a synonym of *V. xutha*. Collection of fresh material by Warnock near the type locality confirms this disposition of the name.

V. xutha is described by Texan collectors as an annual, with lavender or blue-lavender corollas, growing 3.5 dm. to 2 m. tall. It has been found in red sand, low coastal prairies, pastures, wet pinelands, along roadsides through pinelands, and occasional in woods along small creeks.

The *Mrs. P. Cottrell 8743* cited by me in the *Flora of Texas* as *V. xutha* proves, upon re-examination, actually to be *V. Runyoni*.

Aransas Co., *Cory 45879* (Au, Sm), *51177* (Sm). Bastrop Co., *Warnock 46439* (Au, N). Bowie Co., *Letterman 394* (Du). Calhoun Co., *H. Gentry 57* (Au, N, N). Chambers Co., *Cory 50987* (Sm). De Witt Co., *M. Riedel s.n.* [7-4-41] (Au). Ellis Co., *Cory 53386* (N). Fayette Co., *Matthes 13* [Macbride photos 34343] (Kr—photo, N—photo), type collection of *V. Matthesii*; *Warnock 46297* (Au, N). Freestone Co., *Harding 399* (St). Galveston Co., *Cory 51020* (Sm, Sm); *Dapprich 7764*, in part (Sm); *G. L. Fisher s.n.* [San Leon, July 7, 1929] (Bt); *Mrs. A. F. Nelson s.n.* [11-2-41] (Au). Gonzales Co., *C. C. Albers 46092* (Au, N). Grimes Co., *T. V. Weaver 1039* (Ml, N). Hardin Co., *Lundell & Lundell 11522* (N), *14082* (N). Harris Co., *Boon 61* (Au), *291* (Au, N), *20001* (Au, N); *Ferris & Duncan 3268* (Du); *G. L. Fisher s.n.* [Houston, May 18, 1914] (Hp); *Lindheimer s.n.* [Houston, 1843] (Pr); *Lundell & Lundell 13107* (N). Jackson Co., *Tharp s.n.* [8/30/41] (Au), *s.n.* [Sept. 27, 1941] (Au). Jefferson Co., *C. C. Albers 34005* (Au, Au); *Cory 50962* (Sm), *50968* (Sm, Sm); *C. L. Lundell 14135* (N); *Tharp s.n.* [9/12/37] (Au, Au). Leon Co., *E. C. Smith s.n.* [Oakwood, 5-12-1942] (Fe). Liberty Co., *Harding 172* (St). Robertson Co,. *L. Morris 42* (Au). Travis Co., *F. A. Barkley 13365* (Au); *C. L. Lundell 11921* (N); *R. H. Painter 16* (Ka); *Strandtmann s.n.* [July 26, 1940] (Au); *Tharp 668* (Au), *s.n.* [8-7-40] (Au); *York, Copeland, & Johnson 6048* (Au). Victoria Co., *Tharp s.n.* [McFaddin Beach, 9-11-37] (Pl). Walker Co., *Albers & Warnock 45136* (Au, N). Waller Co., *H. B. Parks 2432* (Au). Washington Co., *C. C. Albers 33013* (Au), *33017*, in part (Au); *Brackett 253* (Au), *s.n.* [Apr. 21, 1030] (Au); *E. Hall 434* (Pr). Wharton Co., *E. J. Palmer 6622* (W). County undetermined, *Lindheimer s.n.* [Fasc. IV, 1849] (Ka).

VERBENA RUNYONI Moldenke.

An additional Texan reference is A. M. T. Davis, A study of Boscaje de la Palma in Cameron County, Texas, and of *Sabal texana* (thesis), p. 62 (August, 1942). Mr. L. I. Davis, reports that "the nutlets of *V. Runyoni* are not slightly arched down the back as in *V. neomexicana* and they are

plainly longitudinally striate from top to bottom" and the inflorescence is glandular-viscid before drying. He says "I think we had better assume that neither *V. xutha* nor *V. neomexicana* occurs in Cameron County" and that all specimens so named hitherto are really *V. Runyoni*. "The first part of this month [August] *V. Runyoni* was blooming everywhere hereabouts. Just below San Benito there was a field acres in extent where there was a plant about every two feet. Here according to the soil and moisture supply one could easily find every stage of *V. Runyoni* from the slender one foot high plant to the giant four and a half foot, heavy stemmed plant. But all have the same seeds and pubescence." Texan collectors describe the species as a coarse annual herb, growing in open places in jungles and on the coastal prairies, with lavender or purplish corollas, flowering and fruiting in August.

Brazoria Co., *Lundell & Lundell 11036* (N). Cameron Co., *Cory 36467* (N), *51439* (Sm); *Mrs. P. Cottrell 8743* (Au); *L. I. Davis s.n.* [Southmost, May, 1942] (Au, Sm); *Ferris & Duncan 3160* (Du); *C. L. Lundell 10679* (N), *10681* (Sm), *10709* (N); *Lundell & Lundell 10012* (Ld), *10753* [Plant. Exsicc. Gray. 1274] (Al, Au, H, I, Ka, Ld, N, N, Pl, Sm, St, We); *Rose & Russell 24238* (W); *R. Runyon 3178* [Herb. Texas Agr. Exp. Sta. 43663] (Au), *4187* (Au,N); *Sixth Grade Brownsville 34* (Au), *s.n.* [Nov. 1934] (Au); *Tharp 1201* (Au).

VERBENA RUNYONI f. ROSIFLORA L. I. Davis.

This form has recently been described by Mr. Davis in Nature Leaflet [The Lower Rio Grande Valley Nature Club] 2: [4] (May 10, 1945). It differs from the typical form of the species in having rose-colored flowers.

Cameron Co., *L. I. Davis s.n.* [Southmost, May, 1942] (Au—type, N—photo of type, Z—photo of type).

VERBENA PLICATA Greene.

Texan collectors describe this species as a coarse perennial herb, branched at the base, about 2 dm. tall, the branches erect or ascending, with bluish-violet, blue-purple, or purplish corollas. It has been collected in mesquite grassland, in sand of oak areas, on plains, especially high rocky ones, in deep sand, at edge of woods along rivers, in sand dunes, and frequently along roadsides.

Andrews Co., *Lundell & Lundell 11406* (Sm). Atascosa Co., *E. J. Palmer 9767* (Du). Baylor Co., *Bridge s.n.* [near Seymour, 6/16] (Cn). Bee Co., *Wolcott & Barkley 16T420* (Au). Bexar Co., *Metz 557* (I), *2156* (Se). Brewster Co., *Cory 43929* (Au); *Rose-Innes & Moon 1169* (Au); *Warnock 20436*, in part (Au), *20437* (Au), *21230* (Au). *s.n.* [May 3, 1937] (Au). Brooks Co., *C. L. Lundell 10819* (N), *10827* (N). Cameron Co., *C. L. Lundell 10702*, in part (Sm), *10779* (Sm). Crane Co., *Lundell & Lundell 10232* (Ld). Culberson Co., *U. T. Waterfall 4171* (N), *5172* (Au, N). Ector Co., *Lundell & Lundell 11403* (N); *Tharp s.n.* [7/10/41] (Au). Frio Co., *Lucas, Painter, & Barkley 14227* (Au); *C. L. Lundell 13620* (Sm). Hidalgo Co., *Lundell & Lundell 9820* (Ld), *10038* (Ld), *10069* (Ld); *Mrs. E. J. Walker s.n.* [2/9/42] (Au, Au). Hudspeth Co., *Tharp 43-804* (Au); *U. T. Waterfall 5348* (N). Jeff Davis Co., *C. C. Albers 46259* (Au, N); *Ferris & Duncan 2726* (Du). Jim Wells Co., *Wagner & Barkley 16T314* (Au), *16T322* (Au, N). Kendall Co., *Metz 170* (I). Kleberg Co., *J. F. Sinclair*

s.n. [Kingsville, Spring 1940] (Au). Lubbock Co., *Demaree 7539* (Du). Midland Co., *Cory 42034* (Au); *Lundell & Lundell 10260* (Ld). Mitchell Co., *Cory 48041* (Au); *Lundell & Lundell 11375* (N); *R. W. Pohl 4360* (Sm), *4723* (Sm), *4845* (Sm), *5105* (Sm). Pecos Co., *Lundell & Lundell 10197* (Ld), *10204* (Ld); *Tharp 43–800*, in part (Au); *Warnock 46122* (Au, N). Starr Co., *Lundell & Lundell 9788* (Ld). Sterling Co., *R. W. Pohl 4790* (Sm). Taylor Co., *Tolstead 7103* [Herb. Texas Agr. Exp. Sta. 41986] (Au). Travis Co., *Armer 5380* (Au). Upton Co., *Lundell & Lundell 10223* (Ld). Uvalde Co., *C. L. Lundell 10966* (Sm). Val Verde Co., *Cory 39090* (N). Ward Co., *Cory 51970* (N); *Lundell & Lundell 11381* (Sm); *Tracy & Earle 30* (Cm—isotype). Webb Co., *Lundell & Lundell 10106* (Ld). Wilbarger Co., *Whitehouse 10931* (Sm). Winkler Co., *Lundell & Lundell 11393* (N). Young Co., *Whitehouse 15341* (N). Zapata Co., *Lundell & Lundell 10109* (Ld). County undetermined, *S. Hayes 608* (Du).

VERBENA PLICATA var. DEGENERI Moldenke.

Pecos Co., *Tharp 43–799* (Au), *43–801* (Au), *43–802* (Au), *43–803* (Au).

VERBENA CLOVERI Moldenke.

Field workers in Texas, as reported by me in Phytologia 2: 162 (1946), have come to the conclusion that a lavender-flowered form of *V. Cloveri* cannot be considered a valid variety since "all the flowers are slightly on the lavender side of blue." Miss Thelma Walker thinks that every shade of intergrade is found, and she has had a fine chance to study this because her farm is "literally covered with the plants in the spring." On the basis of this evidence, then, I think that *V. Cloveri* var. *lilacina* Moldenke, as recognized in the *Flora of Texas*, will have to be reduced to synonymy under typical *V. Cloveri*. The species is described as a perennial herb, with lavender or lilac corollas, found in woods, sandy uplands, and in sand along roadsides.

Brooks Co., *C. L. Lundell 10823* (N); *Lundell & Lundell 8834* (Ld), *10072* (Ld); *Painter & Barkley 14315* (Au, N); *Pladeck s.n.* [near Falfurrias, 5–5–1940] (Bt). Frio Co., *C. L. Lundell 13618* (N, S); *Lundell & Lundell 10140* (Ld); *Painter, Lucas & Barkley 14230* (Au); *Tharp s. n.* [Dilley, 2–27–30] (Sm); *Wolcott & Barkley 16271T* (Au, N). Hidalgo Co., *Clover 578* (Du). Kenedy Co., *Lundell & Lundell 10843* (N). Kleberg Co., *J. F. Sinclair s.n.* [Kingsville, Spring, 1940] (Au). La Salle Co., *Lundell & Lundell 10142* (Ld), type collection of var. *lilacina*. Starr Co., *Lundell & Lundell 9795* (Ld). *9886* (Ld). Webb Co., *Lundell & Lundell 10107* (Ld). Zapata Co., *Lundell & Lundell 10112* (Ld).

VERBENA NEOMEXICANA (A. Gray) Small.

The flowers of this species are also recorded as being pink in color. The *Sixth Grade Brownsville 34* and *s.n.* [Nov. 1934] and *Tharp 1201* cited by me in the *Flora of Texas* as this species prove, upon more careful examination, to be *V. Runyoni*.

Jeff Davis Co., *Ferris & Duncan 2606* (Du), *2607* (Du); *Hinckley s.n.* [July 5, 1936] (N).

VERBENA NEOMEXICANA var. HIRTELLA Perry.

Texan collectors have described the corollas of this variety as blue-lavender or purple, and have found the plant in rolling grasslands and on

gravelly mesas, blooming in January. The *Ecology Class Univ. Tex. s.n.* [2.28.30], *R. H. Painter 249*, and *Tharp s.n.* [6-19-31] cited by me in the *Flora of Texas* as this variety prove, upon re-examination, to be *V. canescens* var. *Roemeriana*.

Bexar Co., *O. M. Clark 7441* (Ok). Brewster Co., *Moore & Steyermark 3277* (Du); *L. T. Murray s.n.* [May 22, 1928] (It); *E. J. Palmer 34065* (N—isotype); *Rose-Innes & Moon 1200* (Au); *Rose-Innes & Warnock 537* (Au); *Tharp s.n.* [6-19-31] (Sm), *s.n.* [Wilson Ranch] (Au); *Warnock 20436*, in part (Au), *s.n.* [May 3, 1937] (Au). Hudspeth Co., *U. T. Waterfall 5143* (N). Presidio Co., *Hinckley 1971* (Au); *J. R. Lundell 5* (Ld); *Lundell & Lundell 14340* (N). Travis Co., *C. L. York 46035* (Au, N). Val Verde Co., *M. E. Jones 28296* (Du); *Whitehouse 11479* (Sm).

VERBENA NEOMEXICANA var. XYLOPODA Perry.

The Nelson & Nelson specimen cited below is very anomalous. Its fruiting-calyxes and fruit are much larger than normal. It may prove to represent a new variety, or even a new species.

Presidio Co., *Hinckley 1254* (N). Terrell or Webb Co., *Nelson & Nelson 5138* (Au). Victoria Co., *Owens 3125* (Au). Webb Co., *Perkins & Hall 2627*, in part (Po).

VERBENA PERENNIS Wooton.

This species is described as having perennial roots, and blue, blue-lavender, or purple corollas, the lower lip undulate-margined. It has been collected in Texas on grassy limestone slopes and rocky hillsides.

Brewster Co., *G. L. Fisher s.n.* [Alpine, Aug. 24, 1932] (Hp); *Warnock 287* (Au), *21090* (Au), *21279* (Au), *21827* (Al). Culberson Co., *C. H. Muller 8253* (Sm); *U. T. Waterfall 3795* (N), *4510* (Au, N), *5209* (N, Sm); *Whitehouse 15968* (Sm), *17019* (N). Hudspeth Co., *C. H. Muller 8214* (Sm).

VERBENA CANESCENS var. ROEMERIANA (Scheele) Perry.

Texas collectors describe this plant as a perennial herb, with lavender, purplish, or purple flowers, with a whitish eye. It has been found in dry calcareous soil, xeric limestone-clay loam, on limestone hills and rocky slopes, in xeric scrubland on hills, and along roadsides.

Bee Co., *J. S. Williams 39378* (Au). Bexar Co., *Metz 76* [Aug. 21] (I), *76* [Aug. 24] (I), *881* (I); *E. J. Palmer 9183* (Du); *Texas Agr. Exp. Sta. Herb. Exchange 3496* (Hp). Brewster Co., *Tharp s.n.* [6-19-31] (N), *s.n.* [10-9-36] (Pl, Sm); *Warnock s.n.* [May 3, 1937] (Au). Brooks Co., *Perkins & Hall 2637*, in part (Po). Brown Co., *Reverchon s.n.* [Curtiss 1961] (Cm, Ka). Cameron Co., *C. L. Lundell 10702*, in part (Sm), *10774* (N); *Lundell & Lundell 10023* (Ld), *10760* (Sm). Coleman Co., *Warnock 46334* (Au, N). Comal Co., *C. C. Albers 38004* (Au); *Lindheimer 294* (Ka), *1074* (Br, Me, Me); *Warnock 46244* (Au, Au, N, N). Edwards Co., *Parks & Cory 20841* (Tr). Gaudalupe Co., *Wagner & Barkley 16T438* (Au, N). Hays Co., *Lundell & Lundell 10278* (Ld). Hidalgo Co., *Lundell & Lundell 9819* (Ld); *Mrs. E. J. Walker 30* (Au, N), *34* (Au, Au), *49* (Au, Au), *s.n.* [Feb. 9, 1942] (Au, Au, N); *M. L. Walker 66* (Au). Kendall Co., *Parks & Cory 12929* (Tr). Kerr Co., *E. J. Palmer 10002* (Du). Llano Co., *Correll & Correll 12701* (Sm); *Wolff 3064* (Tr). Mason Co., *Dapprich 7766*

(Sm). Medina Co., *C. L. Lundell 10986* (N). Pecos Co., *Tharp 43–800*, in part (Au). Starr Co., *Ecology Class Univ. Texas s.n.* [2.28.30] (Au); *Lundell & Lundell 9796* (Ld), *9930* (Ld). Sutton Co., *R. W. Pohl 4760* (Sm). Travis Co., *Adamcik & Barkley 16T240* (Au, N); *C. C. Albers 32016* (Au), *34009* (Au); *Albers, Barkley & Warnock 46455* (Au, N); *Barkley & Rowell 41* (Au), *42* (Au, N); *Cohn & Barkley 15148* (Au); *Johnson & Barkley 16T498* (Au); *Lundell & Lundell 8876* (Ld); *R. H. Painter 249* (Au), *392* (Ky); *Rowell & Barkley 16T214* (Au, N), *16T245* (Au, N); *Rowell & Mann 13* (Au); *Tharp 44099* (Au), *s.n.* [11–17–39] (Sm), *s.n.* [7 19 40] (Au); *Tharp, Barkley & Warnock 46271* (Au);*Warnock 86* (Au), *46272* (Au), *46445* (Au); *M. S. Young s.n.* [10/10/13] (Au), *s.n.* [4/29/14] (Au), *s.n.* [4/1/18] (Au), *s.n.* [4/5 18] (Au). Uvalde Co., *C. L. Lundell 10956* (N), *10972* (N); *Lundell & Lundell 10264* (Ld); *H. R. Reed 33818* (N). Williamson Co., *Bodin s.n.* [Georgetown, Dec. 22, 1889] (Ka); *Wolcott 117* (Au).

VERBENA BRACTEATA Lag. & Rodr.

Texan collectors describe this species as an annual with gray-lavender or violet corollas. Demaree states that "old stems will get covered up by sand and dozen of new branches will come up." It has been found in alluvial sandy loam, sandy soil, high plains, dooryards, blackland prairies, and near irrigation ditches. It has been collected at 4200 feet elevation.

Bowie Co., *Correll & Correll 12398* (Sm). Collins Co., *Timmons 743* (Au). Comal Co., *Dapprich 7767* (Sm). Culberson Co., *Tharp 43253* (Au, N). Dallas Co., *F. C. Gates 20972* (Ka); *C. L. Lundell 14015* (Sm). El Paso Co., *Lee, Berkman, & Tharp 46199* (Au, N); *Shinners 8941* (Sm); *Pringle s.n.* [El Paso, 11 June 1885] (Vt). Garza Co., *Tharp s.n.* [7 9 41] (Au, N). Hale Co., *Whitehouse 9926* (N). Hudspeth Co., *Tharp 46152* (Au, N). Hunt Co., *Legget s.n.* [Loneoak, 7/15/1927] (Au); *Tharp 2929* (Au). Lubbock Co., *Demaree 7562* (Du, Du, H), *7704* (Du). Mitchell Co., *R. W. Pohl 4998* (Sm). Presidio Co., *Hinckley 694* (N, Sm). Sherman Co., *Weaver 17793* (Tr). Swisher Co., *Whitehouse 9961* (N). Tarrant Co., *Ruth 109* (Cm, Ka); *Whitehouse 16263* (N). Taylor Co., *Tracy 8001* (Cm, Vt). Wood Co., *C. L. Lundell 12081* (N).

VERBENA CAMERONENSIS L. I. Davis.

Careful comparison of publication records shows that Davis' name for this species was actually published and distributed to botanists and botanical libraries twelve days before the name *V. Lundelliorum* Moldenke was published, so his name becomes the valid name for the species. This was pointed out in my booklets "The Known Geographic Distribution of Members of the *Verbenaceae* and *Avicenniaceae*," pp. 13 & 101 (March 12, 1942) and "An Alphabetic List of Invalid and Incorrect Scientific Names Proposed in the *Verbenaceae* and *Avicenniaceae*," p. 48 (March 14, 1942) and in *Phytologia* 2: 127 (Jan. 4, 1945) and 160 (July 8, 1946). Anna May Tarrance Davis, in her thesis entitled "A study of Boscaje de la Palma in Cameron County, Texas, and of *Sabal texana*," pp. 31, 39, 41, 42, 43, & 61 (August, 1942), gives valuable additional information about this species and on *pl. 10* a splendid illustration of it. Unfortunately, she misspells the synonymous binomial, "*Verbena lundellorum*." The species has been collected on prairies.

Cameron Co., *Cory 51353* (Sm); *L. I. Davis s.n.* [Southmost, Spring '41] (Au—type, Sm—isotype,) *s.n.* [March 7, 1942] (N), *s.n.* [Southmost, March 22, 1942] (Ml, N), *s.n.* (N); *Ecology Class Univ. Texas s.n.* [3.1.30] (Au); *G. L. Fisher 41031* (Au); *C. L. Lundell 10771* (N); *Lundell & Lundell 8698* (Ld), type collection of *V. Lundelliorum, 10011* (Ld), *10014* (Ld).

VERBENA QUADRANGULATA Heller.

Texan collectors describe it as an annual, with pale-lavender, pale-blue, or whitish corollas, growing along railroad tracks, blossoming in November.

Bee Co., *Lundell & Lundell 10050* (Ld). Bexar Co., *Metz 755* (Hp, I). Cameron Co., *Cory 51369* (Sm); *A. M. Davis s.n.* [Olmito, Summer '41] (Au); *C. L. Lundell 10692* (N). Frio Co., *C. L. Lundell 13621* (Sm). Hidalgo Co., *Lundell & Lundell 9803* (Ld); *Mrs. E. J. Walker 41* (Au, N). Jim Wells Co., *Lundell & Lundell 10078* (Ld). La Salle Co., *Lundell & Lundell 10141* (Ld). Nueces Co., *A. A. Heller 1385*, in part (Pl), *1388* (Pl—isotype, Se—isotype). Starr Co., *Lundell & Lundell 9790* (Ld). Upton Co., *Lundell & Lundell 10226* (Ld). Uvalde Co., *M. E. Jones 28298* (Du). Wharton Co., *J. K. Small s.n.* [April 12, 1925] (H, We). Willacy Co., *Cory 51487* (Sm). Zapata Co., *Lundell & Lundell 10124* (Ld). Zavala Co., *Cory 43814* (Au).

VERBENA DELTICOLA Small.

Cameron Co., *L. I. Davis s.n.* [Olmito, Dec. '41] (Au); *Ferris & Duncan 3161* (Du—isotype); *C. L. Lundell 10680* (N), *10758* (N); *Lundell & Lundell 10018* (Ld); *R. Runyon 327* (Au). Hidalgo Co., *Clover 566* (Me); *Lundell & Lundell 9802* (Ld), *9804* (Ld), *9828* (Ld).

VERBENA ELEGANS var. ASPERATA Perry.

This plant was not known from Texas when I prepared my discussion of the family for the *Flora of Texas*. It was first reported from the state in *Phytologia* 2: 162 (1946). The variety is known otherwise only from Mexico (states of Chihuahua, Coahuila, Durango, Hidalgo, Nuevo Leon, San Luis Potosí, Sinaloa, Sonora, Tamaulipas, and Zacatecas). It may be distinguished from *V. canadensis* by being more densely and harshly hispid-hirsute, with the lower leaf-surface lighter than the upper, the spikes compact even at maturity after anthesis, the bractlets being shorter, and the calyx-teeth rarely surpassing 2 mm. in length.

Hidalgo Co., *Mrs. E. J. Walker 32* (N), *s.n.* [Feb. 9, 1942] (Au).

VERBENA CANADENSIS (L.) Britton.

Texan collectors describe this as a perennial herb, and state that the corolla is purple with a reddish eye, pinkish-lavender or lavender with a reddish eye, phlox-lavender or pink. It has been found in upland pinelands.

Anderson Co., *Lundell & Lundell 8478* (Ld). Chambers Co., *Tharp 36006* (Au). Culberson Co., *Hitchcock & Stanford 6782* (N). Denton Co., *A. Nelson 10819* (Du). Falls Co., *Lundell & Lundell 10101* (Ld). Freestone Co., *Lundell & Lundell 10392* (Ld), *11004* (N). Galveston Co., *Mrs. A. F. Nelson s.n.* [3–20–42] (Au). Gregg Co., *C. L. York s.n.* [3–20–38] (Au, Au, Sm). Harris Co., *G. L. Fisher s.n.* [Houston, Apr. 3, 1913] (H, Hp), *s.n.* [Houston, April 3, 1915] (Du), *s.n.* [Houston, April 3, 1920] (Ur), *s.n.* [Houston, Apr. 22, 1923]

(Hp), *s.n.* [Spring, May 4, 1924] (Du, H, Ur), *s.n.* [Mar. 17, 1930] (I); *E. Hall 435*, in part (Pr); *Lindheimer s.n.* [near Houston, March 1842] (Sm). Henderson Co., *Lundell & Lundell 8489* (Ld); *O. Sanders 151* (Sm). Jasper Co., *Lundell & Lundell 11184* (Sm), *11203* (N). Lee Co., *Lundell & Lundell 10094* (Ld). Leon Co., *Lundell & Lundell 10382* (Ld). Milam Co., *Lundell & Lundell 10096* (Ld). Montgomery Co., *D. S. Correll 14168* (Sm). Nacogdoches Co., *Lundell & Lundell 9721* (Ld). Newton Co., *C. C. Albers 39009* (Au). Polk Co., *Girvin 2000* (Au), *s.n.* [March 15, 1940] (Au); *Lundell & Lundell 9723* (Ld), *9724* (Ld), *11291* (N); *Rose-Innes & Warnock 765* (Au); *Tharp s.n.* [3/15/41] (Au, Au). Robertson Co., *Lundell & Lundell 10099* (Ld). Tyler Co., *Lundell & Lundell 9731* (Ld), *10945* (N). Upshur Co., *D. S. Correll 13161* (Sm). Van Zandt Co., *Lundell & Lundell 9698* (Ld), *10437* (Ld).

VERBENA HYBRIDA Voss.

Texan collectors describe the corolla of this cultivated ornamental plant as pale-pink, rose, dark purple, or bright-red with a greenish tube.

Dallas Co., *Lundell & Lundell 9763* (Ld). Jefferson Co., *C. L. Lundell 10936* (N), *10939* (N), *10940* (Sm).

VERBENA TUMIDULA Perry.

Edwards Co., *Cory 38940* (N). Uvalde Co., *Cory 44509* (Au).

VERBENA BIPINNATIFIDA Nutt.

Texan collectors describe this plant as an annual, with quadrangular stems about 2 dm. long, branched at the base, with fragrant flowers. The corolla is described on recent collections as bluish-lavender, dark-lavender, or purplish. It has been found in shallow xeric, rocky, limestone soil, granitic gravel, gravelly roadsides, red sandy calcareous soil, mesquite savannas, sandy loam, along sandy roadsides in prairies, on rolling or broken plains, on rocky slopes and prairies, and occasional in ungrazed parks. The *Lundell & Lundell 10363* cited by me as this species in the *Flora of Texas*, has proved on re-examination to be *V. ciliata* var. *longidentata*.

Andrews Co., *Lundell & Lundell 11405* (Sm). Bastrop Co., *Duval s.n.* (W); *Tharp 2817* (Du). Baylor Co., *Bridge s.n.* [near Seymour, 6/16] (Cn). Bee Co., *F. A. Barkley 16T423* (Au, N); *Lundell & Lundell 10055* (Ld). Bexar Co., *Barkley & Parsons 1* (Au); *Lindheimer 10* (Ka); *Metz 79* (I, Se). Blanco Co., *Lundell & Lundell 10274* (Ld). Borden Co., *Whitehouse 16746* (Sm). Brewster Co., *Warnock W.284* (Au). Burnet Co., *C. C. Albers 38003* (Au, Au); *Barkley & Copeland 38c* (Au, N); *Warnock W.1096* (Au). Caldwell Co., *Strandtmann s.n.* [Dec. 30, 1936] (Au). Collin Co., *Lundell & Lundell 9295* (Ld). Comal Co., *W. H. Kellogg 8* (Au); *Lindheimer 1072* (Br, Me, Me, Me, Ok), *1073* (Br), *1973* (Me, Me, Me); *Rautenberg 1593* (Sm). Cook Co., *Correll & Correll 12989* (Sm). Coryell Co., *Warnock 46413* (Au, N). Crockett Co., *Cory 35469* (N). Culberson Co., *Hitchcock & Stanford 6782* (Po). Dallas Co., *E. Brainerd s.n.* [Dallas, March 28, 1908] (Vt); *C. L. Lundell 11704* (N); *Lundell & Lundell 8333* (Ld), *8534* (Ld), *9137* (Ld), *9181* (Ld), *10416* (Ld), *10568* (Ld), *11315* [Plant. Exsicc. Gray. 1275] (Al, Au, H, I, Ka, Ld, N, Pl, Sm, St, We), *12132* (N); *Reverchon s.n.* [Curtiss 1962*] (Cm, I, Vt); *O. Sanders 113* (Ld); *Shinners 8576* (Sm). Deaf Smith Co., *C. L. Lundell 11457* (N). Denton Co., *Lundell & Lundell 9535* (Ld); *Whitehouse 15590* (N). DeWitt Co., *M. Riedel s.n.*

[7–18–41] (Au). Eastland Co., *Hodge Oak School 18* (Au); *Warnock 46376* (Au). Edwards Co., *M. E. Jones 26228* (Du). Ellis Co., *Cory 39243* (Au); *Lundell & Lundell 9364* (Ld). Erath Co., *Lundell & Lundell 10167* (Ld). Fannin Co., *McCart 2032* (Au). Gillespie Co., *G. Jermy 182* (Ka); *Mainland & Barkley 14522* (Au). Goliad Co., *Lundell & Lundell 10059* (Ld). Gonzales Co., *C. C. Albers 35006* (Au); *Friesner 10376* (Bt); *Pladeck s.n.* [near Gonzales, 3–30–1940] (Bt). Grayson Co., *C. S. Sheldon s.n.* [Denison, June 13, 1891] (Al). Hardeman Co., *Whitehouse 10784* (Sm). Harris Co., *E. Hall 435*, in part (Pr). Hays Co., *Krodel & Warnock 46529* (N); *Warnock & Krodel 19* (Au, Ml, N, N). Jack Co., *Whitehouse 15291* (Sm). Jefferson Co., *Lundell & Lundell 11232* (N). Kerr Co., *V. L. Cory 51759* (N). Kimble Co., *Strandtmann s.n.* [Aug. 19, 1941] (Au). Kinney Co., *Mearns 1274* (Du), *1394* (Du). La Salle Co., *Mauermann 12* (Au). Lynn Co., *Rose-Innes & Moon 1052* (Au). Mason Co., *Dapprich 7770* (Sm). Maverick Co., *M. E. Jones 28300* (Ca), *s.n.* [Eagle Pass, April 27, 1931] (Du). McLennan Co., *C. L. York 46087*, in part (N), *46100*, in part (Au). Nueces Co., *Tharp s.n.* [11–9–39] (Au). Oldham Co., *C. L. Lundell 11462* (N); *Lundell & Lundell 11450* (N). Palo Pinto Co., *J. W. Gillespie 5223* (Du). Parker Co., *Tracy 7999* (Cm, Vt). Randall Co., *Lundell & Lundell 11444* (Sm). Runnels Co., *Lundell & Lundell 10160* (Ld). San Patricio Co., *F. A. Barkley 16T409* (Au, N). Sutton Co., *Cory 39625* (Au, N). Tarrant Co., *F. C. Gates 19134* (Ka); *H. Hapeman s.n.* [Fort Worth, May '94] (Hp); *Ruth 92* (Ll), *107* (Cm, Ka, Sm), *s.n.* [Fort Worth, June 19, 1909] (Po). Taylor Co., *Lundell & Lundell 11364* (N); *Tolstead 6927* (Au); *Tracy 8000* (Cm); *Warnock 46352* (Au, N). Tom Green Co., *Cory 50566* (Sm); *R. W. Pohl 4741* (Sm). Travis Co., *C. C. Albers 33021* (Au), *34011* (Au, Au, Au); *Barkley & Copeland 5* (Au, N), *76* (Au, N); *Barkley & Rowell 44* (Au, N), *103* (Au, N); *Birge 2957* (Au); *Brues 19248* (Sm), *19797* (Sm); *Cintron, Buechner, & Barkley 16T249* (Au, N); *Cohn & Barkley 13252* (Au); *Herb. Hort. Bot. Gothenb. s.n.* [Austin, June 6, 1903] (Go); *J. C. Johnson 6032* (Au, N); *Lundell & Lundell 8826* (Ld), *9095* (Ld); *R. H. Painter 6* (Ka); *R. B. Payton 41* (Au); *Ripperton & Barkley 14542a* (Au, N); *Rose & Russell 24129* (W); *K. E. Smith s.n.* [Austin, 5/1/1935] (Au, Bt, St); *Strandtmann s.n.* [July 17, 1940] (Au); *Tharp 44090* (Au), *s.n.* [Austin, 4/12/35] (Bt, Sm, St), *s.n.* [Austin, 5/9/35] (Au, St); *Tharp & Warnock 46084* (Au); *Thompson & Hamilton 3451* (Se); *Warnock 107* (Au), *46033* (Au); *Webster 5* (Au, N); *H. H. York s.n.* [3–18–08] (Au); *York & Wolf s.n.* [Sept. 29, '08] (Au). Uvalde Co., *C. L. Lundell 10955* (N), *10958* (N), *10975* (N); *Lundell & Lundell 10263* (Ld). Victoria Co., *E. J. Palmer* 9098 (Du). Waller Co., *Dixon 561* (W). Washington Co., *Brackett 253* (Au), *s.n.* [Apr. 1928] (Au, Au). Wichita Co., *Whitehouse 9589* (N), *9609* (N). Williamson Co., *Lundell & Lundell 10369* (Ld); *C. L. York 46207* (Au). County undetermined, *Capt. Bolton s.n.* [April, 1895] (Ka); *L. I. Davis 1* (N), *3* (N); *Lindheimer 232* (Ka).

VERBENA BIPINNATIFIDA var. LATILOBATA Perry.

Hidalgo Co., *L. I. Davis 199* (N).

VERBENA TENUISECTA Briq.

Texan collectors state that the corolla is purple with a minute white eye. It has been found in river-bottoms.

Angelina Co., *Lundell & Lundell 11065* (N). Galveston Co., *Mrs. A. F Nelson s.n.* [3–15–42] (Au). Jasper Co., *Lundell & Lundell 10511* (Ld), *10550* (Ld); *Rose-Innes & Warnock 21818* (Au); *Tharp s.n.* [4–13–41] (Au, N). Jef-

ferson Co., *C. C. Albers 34008* (Au, Au), *s.n.* [8/29/34] (Au); *C. L. Lundell 10937* (N), cultivated. Nacogdoches Co., *Biggar s.n.* [August 6, 1944] (Au). Polk Co., *Girvin s.n.* [March 15, 1940] (Au, N); *Tharp s.n.* [5/14/42] (Au).

VERBENA TENERA Spreng.

This South American species was not known from Texas, even in cultivation, when I prepared my discussion of the family for the *Flora of Texas*. Now it is known to be cultivated there and, like all cultivated vervains, may be expected eventually as an escape or naturalization. It is not nearly as common in cultivation anywhere as *V. tenuisecta*, which it closely resembles, but from which it differs in its bractlets being about half (instead of 1/4) as long as the calyx and densely long-ciliate on the margins and in the short but spreading often hirsutulous pubescence on the calyx (instead of the closely appressed-strigose pubescence seen in *V. tenuisecta*). Lundell reports the corolla as dark-purple and has found it in flower in March.

Jefferson Co., *C. L. Lundell 10938* (N), cultivated.

VERBENA AMBROSIFOLIA Rydb.

Texan collectors describe this species as bushy, 2.5 3 dm. tall, with a spread of about 2.5 dm. and deep-pink corollas, frequent on highway shoulders, grassy flats, and arroyos. It has been collected at an elevation of 1800 meters.

Brewster Co., *Cory 40367* (N, N), *44804* (Au); *Rose-Innes & Moon 1172* (Au); *Warnock 20121* (Au), *20921* (Au), *T.66*, in part (Au), *W.283*, in part (Au). Culberson Co., *Cory 53027* (N); *Moore & Steyermark 3622* (Du); *U. T. Waterfall 4458* (N, Pl); *Whitehouse 16894* (Sm), *16928* (Sm). Hudspeth Co., *Ferris & Duncan 2474* (Du); *Tharp 43–798* (Au), *46212* (Au), *46217* (Au), *46235* (Au, N); *U. T. Waterfall 4895* (N). Jeff Davis Co., *Cory 40365* (Au); *Warnock 21676* (Au); *U. T. Waterfall 4722* (N). Pecos Co., *Tharp 43-796* (Al, Au), *43–797* (Au). Reeves Co., *Cory 52132* (N).

VERBENA WRIGHTII A. Gray.

Texan collectors report that the plant is usually branched from the base, has fragrant flowers with rose-pink corollas, showy in bloom. It has been found on ridges, grassy slopes, rolling grasslands, and infrequently on highway shoulders. It has been collected at an elevation of 5500 feet.

Brewster Co., *Ferris & Duncan 2876* (Du), *3000* (Du); *C. L. Lundell 13185* (N), *Lundell & Lundell 10244* (Ld); *Moore & Steyermark 3324* (Du); *Nelson & Nelson 5025* (Ka); *Rose-Innes & Warnock 586* (Au); *Warnock 20022* (Au), *T.66*, in part (Au), *W. 283*, in part (Au). Crane Co., *Lundell & Lundell 10222* (Ld). Culberson Co., *Hitchcock & Stanford 6782* (Pl, Se). El Paso Co., *Shinners 8994* (Sm). Hudspeth Co., *C. H. Muller 8215* (Sm). Jeff Davis Co., *Cory 53075* (Sm); *Ferris & Duncan 2647* (Du); *Hinckley s.n.* [H. O. Canyon, July 27, 1937] (N); *Lundell & Lundell 10255* (Ld), *13127* (Sm); *McVaugh 7508* (Sm). Pecos Co., *G. L. Fisher s.n.* [July 20, 1936] (Se); *Lundell & Lundell 10177* (Ld); *Warnock C.802* (Au). Presidio Co., *Hinckley s.n.* [July 9, 1941] (Au); *Lundell & Lundell 14339* (N). Reeves Co., *Cory 52259* (N); *Nelson & Nelson 4983* (Au, Ka), *5014* (Au); *U. T. Waterfall 4386* (N). Ward Co., *Tracy & Earle 61* (Cm, Vt).

VERBENA CILIATA Benth.

Texan collectors state that this plant is of prostrate growth and usually makes only a rather limited growth. Its corollas are described as pink-tinged, while Cory states that it is "almost always" white.

Brewster Co., *Cory 35568* (N); *Warnock T.66*, in part (Au), *W.625* (Au). Brooks Co., *C. L. Lundell 10825* (N). Cameron Co., *R. Runyon s.n.* [Brownsville, 1930] (Hp). Edwards Co., *Cory 38871* (N). Hall Co., *R. W. Bennett 44* (Tr). MacMullen Co., *F. A. Barkley 16T301* (Au, N).

VERBENA CILIATA var. LONGIDENTATA Perry.

Texan collectors describe the plant as a prostrate annual, with pink or purple corollas, growing in flats, canyons, and along roadsides.

Bee Co., *Lundell & Lundell 10052* (Ld). Bexar Co., *Barkley & Parsons 8* (Au). Cameron Co., *Cory 51350* (Sm); *L. I. Davis s.n.* [Palm Grove, Summer '41] (Au); *C. L. Lundell 10656* (N); *Lundell & Lundell 8683* (Ld), *9996* (Ld), *10024* (Ld), *10027* (Ld); *Muenscher & Muenscher 14457* (N); *Nealley 116* (W); *Wolcott & Barkley 16T377* (Au, N). Hidalgo Co., *Lundell & Lundell 9801* (Ld), *9805* (Ld). Llano Co., *Lundell & Lundell 14564* (Sm). Lubbock Co., *Demaree 7685* (Du). Nueces Co., *A. A. Heller 1385*, in part (N, Pl, Se); *Tharp s.n.* [11-9-32] (St). San Patricio Co., *Cory 51256* (Sm); *Lundell & Lundell 10087* (Ld). Starr Co., *Lundell & Lundell 9786* (Ld). Travis Co., *Lundell & Lundell 10363* (Ld). Webb Co., *Lundell & Lundell 10105* (Ld). Zapata Co., *Lundell & Lundell 10108* (Ld).

VERBENA CILIATA var. PUBERA (Greene) Perry.

Demaree reports that this plant is common in Lubbock County "but considered rare."

Jeff Davis Co., *Tracy & Earle 162*, in part (Cm—isotype, Tr—isotype, Vt—isotype). Lubbock Co., *Demaree 7460* (Du).

VERBENA RACEMOSA Eggert.

Texan collectors describe this plant as prostrate, with branches about 2.5 dm. long, growing on highway shoulders.

Brewster Co., *Cory 31653* (N), *43930* (Au), *53209* (Sm); *Rose-Innes & Warnock 527* (Au), *21430* (Au); *Warnock 418* (Au), *20105* (Au). Glasscock Co., *Cory 42070* (Au). Jeff Davis Co., *Cory 52245* (N); *Tracy & Earle 106a* (Cm). Pecos Co., *Cory 52155* (Sm); *Lundell & Lundell 10190* (Ld), *10206* (Ld); *H. R. Reed 34064* (N); *Tharp 43-805* (Au), *43-806* (Au), *43-807* (Au), *43-808* (Au); *Warnock T.46* (Au, Au), *46136* (Au, N). Reeves Co., *Cory 52133* (Sm); *Nelson & Nelson 4985* (Au, Ka), *4995* (Au).

VERBENA PUMILA Rydb.

Texas collectors describe this as a prostrate annual on rocky and high limestone hills, high rocky plains, in scrub on hilltops, mesquite prairie and savannas, dry draws, dry sandy soil and sandy loam, deep sand of river-bottoms, gravel roads, alluvial sands near post-oak woods, railroad tracks, cultivated areas along roadsides, and "very abundant and forming masses of color in sandy prairies with scattered mesquite." The very small

corolla is described as bright-pink, reddish-purple, purplish, deep rose-pink, rose-pink, or pinkish-purple with a minute yellow eye.

Archer Co., *Whitehouse 9555* (N), *9614* (N). Baylor Co., *Whitehouse 9630* (N). Bell Co., *Wolff 1373* (Hp). Bexar Co., *Lindheimer 434* (Ka); *Metz 152* (I), *524* (I, I), *3246* (Pl); *Patoni s.n.* [San Antonio, Marzi 1914] (Me, Me). Brewster Co., *Sperry 493* (W). Brooks Co., *Lundell & Lundell 10071* (Ld). Cameron Co., *H. C. Hanson 322* (Ka). Coke Co., *Cory 37143* (N). Comal Co., *Lindheimer 1075* (Br, Me, Me, Me, Ok). Dallas Co., *Lundell & Lundell 8578* (Ld), *9178* (Ld), *12818* (Sm); *J. Reverchon s.n.* [Curtiss 1953**] (Go). Denton Co., *Lundell & Lundell 8431* (Ld). Ector Co., *Lundell & Lundell 11401* (N). Edwards Co., *Cory 37068* (Au), *37070* (N); *M. E. Jones 26220* (Du), *26228* (I). Frio Co., *Painter, Lucas, & Barkley 14201* (Au), *14213* (Au). Hays Co., *Friesner 10401* (Bt). Jack Co., *Whitehouse 15311* (Sm). Jeff Davis Co., *Tracy & Earle 178* (Cm). Kern Co., *E. J. Palmer 9278* (Du). Kinney Co., *Mearns 1282* (Du). Kleberg Co., *J. F. Sinclair s.n.* [Kingsville, Spring, 1940] (Au). Live Oak Co., *Whitehouse s.n.* [March 22, 1931] (Sm). Llano Co., *G. L. Fisher s.n.* [Bluffton, Apr. 20, 1931] (Bt); *Rose-Innes & Warnock 793* (Au). Lubbock Co., *Demaree 7450* (Du). Medina Co., *C. L. Lundell 10981* (N). Mitchell Co., *R. W. Pohl 4843* (Sm). Montague Co., *Whitehouse 15038* (N). Randall Co., *Lundell & Lundell 11435* (N). Red River Co., *Wilfong 16* (Sm). Reeves Co., *Tracy & Earle 106* (Cm). Schleicher Co., *Cory 34444* (N). Sutton Co., *R. W. Pohl 4759* (Sm). Tarrant Co., *Ruth 110* (Cm). Taylor Co., *Tolstead 7071* (Au, Au). Tom Green Co., *Cory 40913* (N). Travis Co., *C. C. Albers 34006* (Au); *Armer s.n.* [Austin, 4-2-29] (Pl); *E. Hall 431* (Pr); *E. J. Palmer 9339* (Du); *Tharp 1362* (Au), *1364* (Au), *44116* (Au); *Warnock 20623* (Au), *46086* (Au); *M. S. Young s.n.* [2 28 14] (Au, N). Ward Co., *Lundell & Lundell 11382* (Sm). Wichita Co., *Whitehouse 9513* (N), *9524* (N), *9664* (N), *9669* (N), *10903* (Sm). Wilbarger Co., *Whitehouse 9817a* (N). Williamson Co., *Wolcott 121* (Au). Young Co., *Whitehouse 15323* (N). County undetermined, *Turpin s.n.* (Au, Au); *M. S. Young s.n.* [west of I & GN Ry.] (Au).

STYLODON CARNEUS (Medic.) Moldenke.

Texan collectors report this plant from dry sandy open places.

Hardin Co., *E. J. Palmer 9559* (Du). Jasper Co., *Lundell & Lundell 10552* (Ld).

LANTANA HORRIDA H.B.K.

An additional synonym is *Lantana rubra* Berland. in Teran. & Berland., Mem. Comision Limites 15 (1832). Texan collectors describe the plant as a perennial herb or low bush, with woody roots, very fragrant flowers, and iridescent blue or steel-blue-black fruit. The corollas are described as orange, red-orange, or dark-yellow, or yellow with an orange throat, the old ones deep-pink suffused with orange, the buds pink. It has been found in sand, often in deep sands, sandy loam, mesquite woods, and along roadsides, also on banks of irrigation ditches, in cleared areas in brushy woods, among bushes and shrubs on low coastal dunes, and on blackland prairies.

Aransas Co., *Cory 45381* (Au), *45740* (Au), *51172* (Sm). Atascosa Co., *E. J. Palmer 9764* (Du). Bexar Co., *Metz 57* (Se); *H. B. Parks 15596* (Kr). Brooks Co., *Lundell & Lundell 8829* (Ld). Cameron Co., *Cory s.n.* [11-14-1940] (N); *Ferris & Duncan 3207* (Du); *C. L. Lundell 10788* (N); *Lundell & Lundell 8626*

(Ld), cultivated, *8638* (Ld), *8667* (Ld); *R. Runyon s.n.* [Brownsville, 1930] (Hp). Comal Co., *Dapprich 7774* (Sm); *Lindheimer 334* (Ka), *1068* (Br, Me, Me, Me). De Witt Co., *M. Riedel s.n.* [7–27–41] (Au). Gonzales Co., *F. A. Barkley 13882* (Au); *Tharp s.n.* [Ottine, 5/1/35] (Bt, St). Guadalupe Co., *Groth 185* (It). Harris Co., *G. L. Fisher s.n.* [May 14, 1916] (Du), *s.n.* [Houston, May 16, 1916] (Hp). Hays Co., *Heald & Wolf 911* (Au); *Strandtmann s.n.* [San Marcos, Apr. 23, 1937] (Au). Hidalgo Co., *Cory 51338* (Sm); *Lundell & Lundell 9841* (Ld); *Walker & George 133* (Au). Jim Wells Co., *Ferris & Duncan 3047* (Du); *Wagner & Barkley 16T342* (Au, N). Karnes Co., *Wright & Wright s.n.* [March 23, 1925] (It). Kenedy Co., *F. A. Barkley 16T386* (Au, N). Llano Co., *G. L. Fisher s.n.* [Llano, Apr. 21, 1930] (Bt). Medina Co., *Tharp s.n.* [Devine] (Au). Nueces Co., *A. A. Heller 1386* (It, Pl); *Perkins & Hall 2617* (It). Starr Co., *Lundell & Lundell 9909* (Ld). Tarrant Co., *Whitehouse 16027* (N). Travis Co., *C. C. Albers 32017* (Au); *Barkley & Warnock 46280* (Au, N); *Harpin, Waldorf, & Barkley 13076* (Au); *Lundell & Lundell 8928* (Ld); *R. H. Painter 85* (Ka); *Tharp 44155* (Au), *s.n.* [Austin, 5/9/35] (Au, Bt, N, St). Victoria Co., *P. O. Schallert 555*, in part (H). Washington Co., *C. C. Albers 34012* (Au); *Brackett s.n.* [July 1938] (Au). Willacy Co., *Cory 51480* (Sm); *Lundell & Lundell 8751* (Ld), *8754* (Ld); *Tharp 1197* (Au). Zapata Co., *Cory 35916* (N); *Lundell & Lundell 12671* (N). County undetermined, *Dapprich 7772*, in part (Sm); *Nealley s.n.* [s.w. Texas, 1888] (Fc).

LANTANA CAMARA L.

The typical form of this species was not known from Texas when I prepared the discussion of the family for the *Flora of Texas*. The reports in the literature at that time were regarded by me as erroneous. Since that time, however, two collections of this plant have reached me, one from a cultivated specimen in Dallas Co., the other apparently from a naturalized plant in Travis Co. (at least, the label does not indicate that the plant was in cultivation). It may be distinguished from var. *mista* by its unarmed or only slightly prickly stems and branches, the young branchlets and twigs not densely spreading-hirsute, but merely puberulent or appressed-strigillose. Shinners describes his plant as having herbaceous rather stiff stems, up to 0.4 m. tall, dark-green foliage, salmon-red buds, the central flowers orange-yellow (scarlet in age), the marginal flowers scarlet-orange, blooming in May, cultivated in partial shade in blackland clay.

Dallas Co., *Shinners 8526* (Sm), cultivated. Travis Co., *Warnock 11* (Au).

LANTANA CAMARA var. MISTA (L.) L. H. Bailey.

Travis Co., *J. L. White 4732* (Au). County undetermined, *Dapprich 7772*, in part (Sm).

LANTANA MACROPODA Torr.

As has been pointed out by Mr. Cory [see *Phytologia* 2: 156. 1946] the key to the species of *Lantana* in the *Flora of Texas* should be modified so that the line leading to *L. citrosa* reads "Leaves appressed-serrulate or subentire," and the line leading to *L. macropoda* reads "Leaves broadly crenate to coarsely serrate, with spreading teeth." Texan collectors describe *L. macropoda* as a straggling or clambering shrub. The corolla is said to be

lavender or pink, with a minute yellow or yellowish eye or without any eye. It has been found on rocky slopes, in scrub on gravel, in thickets, on dry rocky slopes, in low open ground, in scrub on ridges, in the protection of mesquite bushes, and frequent in cleared areas of brushy woods. It has been found at an elevation of 1370 meters. *Cory 51382* gives one the general impression of a drawfed *L. achyranthifolia* Desf., of Mexico.

Bexar Co., *Staltzenburg s.n.* (It). Brewster Co., *Ferris & Duncan 2825* (Du); *Moore & Steyermark 3350* (Du); *C. H. Muller 8142* (Sm), *32016* (Au), *s.n.* [Chisos Mts., 7–17–32] (Au); *Warnock 253* (Au), *831*, in part (Au), *s.n.* [May 2, 1937] (Au, Au). Cameron Co., *Cory 51382* (Sm); *C. L. Lundell 10776* (N); *Lundell & Lundell 8641* (Ld); *Small & Wherry 11841* (Ml); *Wright & Wright s.n.* [April 17, 1925] (It). Dimmit Co., *Texas Agr. Exp. Sta. Herb. Exch. s.n.* [12–10–39] (Tr). Duval Co., *F. A. Barkley 13889* (Au). Hidalgo Co., *Cory 36035* (N), *51332* (Sm); *Ferris & Duncan 3072* (Du); *Lundell & Lundell 9800* (Ld), *9849* (Ld); *M. L. Walker 105* (Au); *Wiegand & Weigand 1986* (It). Houston Co., *S. M. Tracy 9146* (It, Up). Jim Hogg Co., *C. L. Lundell 11957* (N). Kinney Co., *H. B. Parks P X.002* (Au). La Salle Co., *C. L. Lundell 14517* (N). Presidio Co., *Hinckley 1502* (Au, N). Reeves Co., *Tharp 8852* (N). Starr Co., *Clover 1395* (I); *Cory 35934* (N); *Lundell & Lundell 9789* (Ld), *9904* (Ld); *Nealley 240* (Du). Uvalde Co., *E. J. Palmer 11028* (Du). Val Verde Co., *D. S. Correll 13480* (Sm); *Cory 31715* (N), *38096* (Au), *38097* (N), *39745* (Au), *39746* (N); *G. L. Fisher s.n.* [Devils River, July 14, 1927] (Hp); *M. E. Jones 26218* (Du, I, It); *Rose-Innes & Moon 1292* (Au); *Rose-Innes & Warnock 602* (Au); *Whitehouse 11478* (Sm). Zapata Co., *Cory 35922* (N). County undetermined, *C. Wright 458*, in part (Du).

LANTANA CITROSA (Small) Moldenke.

Cameron Co., *Cory 36729* (N).

LIPPIA ALBA (Mill.) N. E. Br.

The claim made by A. D. J. Meeuse in *Blumea* 5: 68–69 (1942) that *L. javanica* (Burm. f.) Spreng. is the correct name for this species, is erroneous. I have examined a portion of the type specimen of *L. javanica* and find it to represent the African species hitherto known as *L. scabra* Hochst., which name it has to replace. It has nothing to do with *L. alba!*

Texan collectors describe *L. alba* as a perennial, the corollas lavender or lavender with a yellow eye.

Cameron Co., *Cory 51445* (Sm); *A. M. Davis s.n.* [Palm Grove, Sept. '41] (Au); *G. L. Fisher s.n.* [Brownsville, Aug. 16, 1924] (Hp), *s.n.* [Apr. 20, 1941] (Au, Au); *C. L. Lundell 10644* (N); *Lundell & Lundell 8685* (Ld); *Nealley 113* (Up); *Perkins & Hall 2618* (It); *R. Runyon* 228 (N), *s.n.* [Brownsville, 1930] (Hp). Hidalgo Co., *Cory 36288* (N); *M. L. Walker 34* (Au).

LIPPIA GRAVEOLENS H.B.K.

The species is described by Texan collectors as a low shrub, 2 feet tall, found in scrub on gravelly hills, in canyons, and in cleared areas of brushy woods.

Brewster Co., *H. C. Hanson 709* (Ka); *Warnock 831*, in part (Au). Cameron Co., *Nealley s.n.* [Pt. Isabel, 1891] (Au). Hidalgo Co., *Cory 51337* (Sm);

Lundell & Lundell 8803 (Ld), *9807* (Ld), *9906* (Ld); *I. Shiller 736* (Au); *Mrs. E. J. Walker 22* (Au), *s.n.* [Rio Grande Valley, Feb. 2, 1942] (Au, Sm); *M. L. Walker 104* (Au); *Wiegand & Wiegand 1987* (It). Houston Co., *S. M. Tracy 9158* (It, Up). Maverick Co., *Pringle 9034* (It, Me, Me, Me, Vt). Starr Co., *Clover 1676* (I). Val Verde Co., *Cory 38065* (N); *G. L. Fisher s.n.* [Langtry, July 18, 1922] (Hp, Vt). Webb Co., *M. E. Jones 29186* (It). Zapata Co., *Cory 35930* (N). County undetermined, *Nealley 313* (Du).

PHYLA LANCEOLATA (Michx.) Greene.

Texan collectors describe the species as a prostrate, trailing, annual or perennial herb, the stems erect and about 3 dm. tall, the branches decumbent, longer and rooting at the nodes. The corolla is described as either white with an orange-yellow, yellowish, or rose eye, or pinkish with a rose eye, or lavender or pink with a darker eye. The leaves are often reported as purplish. The plant has been found on floating islands, in wet areas, low moist ground, the edges of lakes, and in colonies in mud near water in sloughs.

Anderson Co., *F. A. Barkley 13586* (Au). Austin Co., *Tharp s.n.* [6 28 42] (Au). Bowie Co., *C. L. Lundell 13981* (N). Brazoria Co., *E. J. Palmer 6704* (It). Colorado Co., *Barkley, Warnock, & Tharp 46448* (Au, N). Dallas Co., *C. L. Lundell 11576* (N), *11621* (N), *11656* [Plant. Exsicc. Gray. 1276] (Al, Au, H, I, Ka, N, Pl, Sm, Sm, St, We), *14038* (N); *Ruth 1582* (Sm). Donley Co., *Whitehouse 17263* (N). Gonzales Co., *Strandtmann s.n.* [Aug. 12, 1940] (Au); *Tharp 44182* (Au), *s.n.* [8–3–37] (Sm), *s.n.* [8–10–40] (Pl, Sm). Harris Co., *Boon 53* (Au); *Lundell & Lundell 13092* (N). Jackson Co., *Tharp s.n.* [Aug. 27, 1941] (Au, N, Sm). Kaufman Co., *Cory 53264* (N). Liberty Co., *Langman 1945* (Up). Lubbock Co., *E. L. Reed 3827* (I). Matagorda Co., *Tharp s.n.* [8 30 38] (Sm).

PHYLA INCISA Small.

Texan collectors describe it as a perennial, growing from a taproot, with stems matted, new shoots growing from the prostrate half of apparently "dead" stems, growing in spreading patches, the peduncles erect, the corolla white with a wine or yellow-brown eye, or white with a pale-lavender tinge, the yellow eye turning reddish or browning in age. The corolla has also been described as pale lilac-lavender or pale rosy-lavender with a deep-yellow center turning brown in age. The "calyx" is described as gray-violet. It has been found in moist soil of canyons, among rocks in creek-beds, in low area of sand in oak regions, in prairies, in blackland clay, railroad ditches, and trailing in sand; also in joints of limestone bedrock, on limestone hills, and in disintegrating limestone in open wet areas. It has been collected at an elevation of 4400 feet.

Bell Co., *Cohn T.21* (Au); *L. McLean s.n.* [Temple, 8-30-34] (St); *J. F. Normand s.n.* [1928] (N, N). Bexar Co., *Groth 72* (It); *Metz 9* (I), *88* (I, I), *159* (I), *s.n.* [Aug. 10, 1931] (Se); *Staltzenburg s.n.* (It). Bowie Co., *Correll & Correll 12404* (Sm); *C. L. Lundell 13980* (N). Brazos Co., *Chenault s.n.* [May 15, 1937] (Au). Brewster Co., *Moore & Steyermark 3427* (Du); *Warnock 20435* (Au), *20676* (Au), *20741* (Au). Brooks Co., *C. L. Lundell 10810* (N), *11945* (N); *Tharp s.n.* [6 26 41] (Au). Calhoun Co., *Cory 49075* (Sm), *51130* (Sm). Cameron Co., *A. M. Davis s.n.* [Palm Grove, Sept. '41] (Au); *Ferris & Duncan*

3086 (Du); *Lundell & Lundell 8637* (Ld); *R. Runyon 2085* (N). Colorado Co., *E. J. Palmer 6593* (It). Comal Co., *Lindheimer 262* (Ka), *288* (Ka), *1069* (Br, Me, Me, Ok). Crockett Co., *Parks & Cory 18896* (N). Dallas Co., *M. A. Hynes s.n.* [Dallas, [6/2/26] (Au), *s.n.* [7–1926] (Sm); *C. L. Lundell 12033* (N, Si); *Shinners 8508* (Sm), *8575* (Sm). Edwards Co., *G. L. Fisher s.n.* [Rock Springs, July 19, 1935] (Bt). El Paso Co., *Cory 45055* (Au); *G. W. Dunn s.n.* [July 20, 1887] (Up), *s.n.* [July, 1887] (Du); *F. W. Johnson 1707* (Go); *M. E. Jones 4208* (Br, Du, Du, It); *Lee, Berkman, & Tharp 46190* (N); *Mearns 1508* (Du); *Shinners 8919* (Sm). Fayette Co., *E. W. Crawford s.n.* [Colony, June, *1892*] (Ka). Fort Bend Co., *Munz s.n.* [June 23, 1917] (It). Frio Co., *Wolcott & Barkley 16T242* (Au, N). Galveston Co., *G. L. Fisher s.n.* [Galveston, Aug. 31, 1919] (H); *E. C. Smith s.n.* [between Houston and Galveston, 5-2-1942] (Fc). Grayson Co., *Schleuse 36008* (Au), *s.n.* [Denison, 8/31/36] (Sm). Gregg Co., *C. L. York s.n.* [9–2 39] (Au), *s.n.* [Aug. 28, 1941] (Au). Harris Co., *Boom 300* (Au, N), *386* (Au, N); *G. L. Fisher s.n.* [Houston, May 4, 1918] (Vt). Hudspeth Co., *U. T. Waterfall 4589* (N, Pl). Jackson Co., *Drushel 10260*, in part (Ok); *Tharp s.n.* [Aug. 28, 1941] (Au, N), *s.n.* [Sept. 3, 1941] (Au, Au, N). Jefferson Co., *Wherry s.n.* [September 7, 1936] (Up). Kenedy Co., *F. A. Barkley 16T387* (Au, N); *Wagner & Barkley 16T326* (Au, N). Kerr Co., *A. A. Heller 1920* (Se). Kinney Co., *Cory 33472* (N). Kleberg Co., *Perkins & Hall 2619* (It); *J. F. Sinclair s.n.* [Kingsville, Spring 1940] (Au). La Salle Co., *Wright & Wright s.n.* [April 3, 1935] (It). Midland Co., *Cory 40613* (N). Mitchell Co., *R. W. Pohl 4599* (Sm). Nueces Co., *A. A. Heller 1806* (It—isotype, N—isotype, Pl—isotype, Se—isotype). Palo Pinto Co., *J. W. Gillespie 5202* (Du). Pecos Co., *Ferris & Duncan 2897* (Du). Presidio Co., *Hinckley 691* (Ld, N), *s.n.* [San Esteban Lake] (Au), *s.n.* [Marfa, July, 1936] (Au). Reeves Co., *U. T. Waterfall 4361* (N), *4372* (N). Refugio Co., *Tharp s.n.* [Austwell, 9–7–1929] (Au, Pl). Robertson Co., *F. A. Barkley 13003* (Au). Somervell Co., *O. Sanders 197* (Sm), *s.n.* [Glen Rose, June 1940] (Sm). Tarrant Co., *Letterman 391* (Ka); *Ruth 91* (Ll), *106* (Ca, It, La, Sm, Up). Taylor Co., *Tolstead 7550* [Herb. Texas Agr. Exp. Sta. 42551] (Au, Au). Tom Green Co., *Cory 39600* (Au), *39602* (N). Travis Co., *Albers, Barkley, & Warnock 46450* (Au, N); *F. A. Barkley 16T524* (Au, N); *Barkley & Copeland 56* (Au, N); *Barkley & Warnock 46263* (Au, N); *Cohn & Barkley 13193* (Au), *13245* (Au); *A. M. Ferguson s.n.* [Waller Creek] (Au); *E. Hall 436* (Pr); *Heald & Wolf s.n.* [Austin, 4–30–09] (Au); *Krodel 30* (Au, Au); *LaMotte, Throckmorton, & Barkley 16T246* (Au, N); *Lundell & Lundell 9119* (Ld); *Rowell & Mann 4* (Au); *Strandtmann s.n.* [July 17, 1940] (Au); *Tharp 44138* (Au), *44188* (Au), *s.n.* [Austin, 5–15–35] (Bt, St), *s.n.* [Austin, 5/10/38] (Pl), *s.n.* [Mt. Bonnell, 7–18–41] (Sm), *s.n.* [7–18–41] (Au, Au, N), *s.n.* [Mt. Bonnell, 7/31/41] (Sm), *s.n.* [August, 1941] (Au); *Waldorf 19* (Au). Val Verde Co., *Cory 37997* (N). Victoria Co., *P. O. Schallert 550* (H). Washington Co., *C. C. Albers 33022* (Au); *Brackett 20* (Au), *253* (N), *s.n.* [Apr. 30, 1939] (Au). Willacy Co., *Cory 36726* (N). Williamson Co., *C. L. York 46130* (Au, N), *46174* (Au, N). County undetermined, *Lindheimer s.n.* (Ka).

PHYLA CUNEIFOLIA (Torr.) Greene.

As has been suggested by Mr. Cory [see *Phytologia* 2: 157. 1946] the key given to the species of this genus in the *Flora of Texas* should be modified. The second line, leading to *P. cuneifolia*, should read "Heads 8–13 mm. wide; bractlets broadly obovate-cuneate, acuminate at the apex, about 5 mm. long and 3 mm. wide; peduncles often shorter than

the subtending leaves . . . . etc.," while the line leading to *P. incisa*, immediately below it, should read "Heads 5–7 mm. wide; bractlets narrowly obovate or the outermost ovate, 2–3 mm. long, 1–1.5 mm. wide; peduncles much longer than the subtending leaves. . . .etc." Texan collectors describe the corollas of *P. cuneifolia* as lavender, pinkish-lavender, or white and lavender, very fragrant. The species has been found in roadside ditches, on high plains, in sandy soil, along railroad tracks, on sandy high plains, in lake beds, forming mats along roadsides, and abundant in heavy black silt or clay loam.

Brewster Co., *Warnock 20736* (Au), *20737* (Au), *21204* (Au), *21277* (Au), *s.n.* [July 23, 1940] (Au). Carson Co., *Shinners 8107* (Sm). Crockett Co., *Cory 18895* (N), *18897* (N), *32749* (N), *37357* (Au), *39334* (Au), *39335* (N). Culberson Co., *U. T. Waterfall 4685* (N). Dallam Co., *Shinners 8188* (Sm). Hale Co., *Whitehouse 9933* (N). Howard Co., *S. M. Tracy 7998* (Cm, It). Jeff Davis Co., *Hinckley 466* (N). Lubbock Co., *Demaree 7714* (Du). Midland Co., *Cory 40613* (Au). Ochiltree Co., *Headlee 56* (Tr). Oldham Co., *M. W. Howard 25* (Au). Potter Co., *G. J. Goodman 3052* (N, Se). Reagan Co., *Cory 12540* (Au). Schleicher Co., *Cory 34447* (N). Scurry Co., *Tharp s.n.* [7/9/41] (Au, N). Swisher Co., *Whitehouse 9950* (N). Taylor Co., *Tolstead 7547* [Herb. Texas Agr. Exp. Sta. 42543] (Au). Travis Co., *Tharp s.n.* [8–15–1931] (Sm).

PHYLA NODIFLORA (L.) Greene.

Texan collectors describe this species as a prostrate herb, the branches rooting at the nodes, extensively creeping on moist sand of beaches and along roadsides through pinelands.

Aransas Co., *Cory 45739* (Au). Chambers Co., *Cory 50985* (Sm). Galveston Co., *H. Hapeman s.n.* [Galveston, May 10, '94] (Hp); *Tharp s.n.* [5–1–37] (Pl). Hardin Co., *Lundell & Lundell 11520* (N). Harris or Jefferson Co., *Crockett 7002* [between Beaumont and Houston] (Au). Kerr Co., *H. R. Reed 45998* (Au). McLennan Co., *C. L. York 46161* (Au, N). Nueces Co., *C. C. Albers 32021* (Au).

PHYLA NODIFLORA var. REPTANS (H.B.K.) Moldenke.

Texan collectors describe this plant as a decumbent herb, growing in low ground, on gravel bars, and on rocks at the edge of rivers. In my discussion of this variety in the *Flora of Texas* a good many specimens were cited which, upon re-examination, prove to be different from it. The following collections are actually *P. incisa: M. A. Hynes s.n.* [Dallas, 6–2–26], *E. Beck 58, Hinckley s.n.* [Marfa, July, 1936] and *s.n.* [San Esteban Lake], and *Tharp s.n.* [Austwell, 9–7–1929]. The following collections, previously cited as *P. nodiflora* var. *reptans*, are actually *P. strigulosa: Cory 28215, Mrs. P. Cottrell s.n.* [San Benito, Feb.–Apr. 1931], *Ferris & Duncan 3091, H. C. Hanson 508, Lundell & Lundell 10013, R. Runyon 350, 2688, s.n.* [Harlington, May 11, 1941], *Small & Wherry 11892, Seventh Grade Brownsville s.n.* [Brownsville, April, 1934], and *Tharp 1203*. The following collections are actually *P. strigulosa* var. *parvifolia: Clover 119, Berlandier 867* and *2287*, and *Lundell & Lundell 9922*.

Cameron Co., *Cory 36468* (N); *R. Runyon s.n.* [Brownsville, 1930] (Hp).

Chambers Co., *Tharp s.n.* [4—7/10/36] (N). Comanche Co., *Lindheimer 1071* (Br, Me, Me, Ok). Edwards Co., *Cory 37901* (Au). Hays Co., *Warnock & Krodel 11* (Au, N). Kerr Co., *C. C. Albers 46073* (Au); *A. A. Heller 1920* (It); *E. J. Palmer 10086* (Du). Tom Green Co., *Cory 39321* (Au), *42826* (Au). Travis Co., *C. C. Albers 32030* (Au); *Armer 5532* (Au); *Tharp s.n.* [5/10/38] (Sm), *s.n.* [7/10/39] (N). Uvalde Co., *Cory 38212* (Au), *39428* (Au), *39429* (N), *44511* (Au); *Lundell & Lundell 13815* (N). Val Verde Co., *Whitehouse 11461* (Sm). Wichita Co., *Tharp s.n.* [5–28–22] (N).

PHYLA STRIGULOSA (Mart. & Gal.) Moldenke.

Lippia strigulosa Mart. & Gal., Bull. Acad. Brux. 11 (2): 319. 1844.
Phyla yucatana Moldenke, Phytologia 2: 140–141. 1946.

This species was hitherto confused and combined with *P. nodiflora* var. *reptans* by me. Since writing up this group for the *Flora of Texas*, however, I have been able to see the type collection of *Lippia reptans* H.B.K., on which *Phyla nodiflora* var. *reptans* is based. This type is a Venezuelan plant, quite different from much of what has been passing under this name. The decidedly ovate or ovate-elliptic leaved specimens, the leaves usually conspicuously widest below the middle, the margins conspicuously and regularly dentate, with the midrib and 4–6 pairs of regular, strong, and rather straight secondaries very prominent and conspicuous beneath, are obviously a different species entirely. Because the majority of this material came from the Yucatan Peninsula I named the species *Phyla yucatana*. Since then, however, I have seen the type material of *Lippia strigulosa* Mart. & Gal. and this proves to be exactly the same thing. The species, therefore, has to be called *P. strigulosa*. A full description will be found in *Phytologia* 2: 140–141 (1946).

Texan collectors describe the plant as a trailing perennial, with decumbent stems, rooting at the nodes, the corolla pale lavender with a rose-purple eye or nearly white, blossoming in March, June, and September, growing on logs and in mucky alluvial soil.

Cameron Co., *Mrs. P. Cottrell s.n.* [San Benito, Feb.-Apr. 1931] (Au); *A. M. Davis s.n.* [Palm Grove, Sept, '41] (Au); *Ferris & Duncan 3091* (Du, N); *H. C. Hanson 508* (N); *Lundell & Lundell 10013* (Ld, N), *10642* (N), *10755* (N); *R. Runyon 350* (Au, N), *2688* (N), *s.n.* [Harlington, May 11, 1941] (N); *Seventh Grade Brownsville s.n.* [Brownsville, April 1934] (Au, N); *Small & Wherry 11892* (N); *Tharp 1203* (Au, N). Hidalgo Co., *Cory 28215* (N); *Mrs. E. J. Walker s.n.* [La Joya, April 1942] (Au); *M. L. Walker 107* (Au). Wood Co., *Whitehouse 16483* (Sm).

PHYLA STRIGULOSA var. PARVIFOLIA (Moldenke) Moldenke.

Phyla yucatana var. *parvifolia* Moldenke, Phytologia 2: 141–142. 1946.

This variety, like the species, was previously confused and combined with *P. nodiflora* var. *reptans* by me. It was shifted to varietal status under *P. yucatana* before I realized that *P. strigulosa* has to become the accepted name for that species. The variety differs from the typical form of the species in being smaller in all its parts and more conspicuously canescent-strigose throughout. The stem and branches are often slightly woody; the

internodes are often reduced to 1 cm. or less; the petioles are obsolete or only 1–2 mm. long; the leaf-blades are usually less than 1 cm. long and wide, with the venation plainly impressed above and prominent beneath, imparting a decided plicate appearance to the leaves, conspicuously canescent-strigose. Texan collectors describe it as a perennial herb, with corollas nearly white, tinged lavender, blooming in April, growing about shallow ponds and in roadside ditches.

Burnet Co., *H. Gentry 10* (Au). Hidalgo Co., *Clover 119* (N). Presidio Co., *U. T. Waterfall 4782* (N). Starr Co., *Lundell & Lundell 9922* (Ld, N). Uvalde Co., *E. J. Palmer 10223* (Du). County undetermined, *Berlandier 867* (T), *2287* (C).

ALOYSIA MACROSTACHYA (Torr.) Moldenke.

Texan collectors report the corolla of this plant as rose-colored, in addition to the colors reported in the *Flora of Texas*, and have found the plant also on ridges in addition to the habitats listed in that work.

Hidalgo Co., *Clover 1075* (I), *1664* (Du); *Lundell & Lundell 9844* (Ld), *9852* (Ld), *9950* (Ld); *Mrs. E. J. Walker 20* (Au, Au); *T. R. Walker s.n.* [summer, 1938] (Au). Live Oak Co., *C. L. Lundell 11931* (N); *Owens 1717* (Au); *H. B. Parks 2043* (Au). Starr Co., *Lundell & Lundell 9917* (Ld). Zapata Co., *Cory 35913* (N).

ALOYSIA WRIGHTII (A. Gray) Heller.

Texas collectors describe this as a low shrub 3–5 feet tall or less, straggling in growth, aromatic in all its parts, the flowers with a delicate lemon fragrance, growing on dry rocky hillsides, grassy mountainsides, foothills, shrubby grassland transition, dry limestone hills, and in granite and on gravel with *Larrea;* also in rocky draws. It has been collected at an elevation of 1025 meters.

Brewster Co., *C. C. Albers 46210* (Au, N); *C. L. Lundell 13245* (N, Si); *Warnock 308* (Au, Au), *308b* (Au), *20051* (Au), *20438* (Au), *21272* (Au). Coke Co., *E. J. Palmer 11164* (Du). Culberson Co., *D. S. Correll 13977* (Sm); *Whitehouse 16982* (N). El Paso Co., *Lee, Berkman, & Tharp 46174* (N); *Mearns & Wagner 966* (Du); *Shiner 40171* (Au); *Whitehouse 11477* (Sm); *C. Wright 460* (Du). Jeff Davis Co., *Hinckley s.n.* [Aug. 22, 1939] (N); *C. L. Lundell 13179* (N); *Lundell & Lundell 13134* (N); *M. S. Young s.n.* [Davis Mts., Aug. 11, '14] (Se). Live Oak Co., *Whitehouse 11481* (Sm). Pecos Co., *Tharp 43-795* (Au), *253* (H). Presidio Co., *Hinckley 1892* (Sm), *s.n.* [July 8, 1941] (Au); *Lundell & Lundell 14293* (N); *McVaugh 7443* (Sm); *C. H. Muller 8428* (Sm).

ALOYSIA LIGUSTRINA (Lag.) Small.

Texas collectors describe the bark of this plant as light gray. The species grows on gravelly sand-bars in creek beds, in thickets on dry calcareous soil, in low areas and on slopes, red sandstone slopes, arroyos, waste ground, and in stony soil with *Fallugia, Chilopsis, Acacia,* and *Aloysia Wrightii.* It is said to be abundant on granite hills and sometimes forms entire thickets. It has been collected at an elevation of 4800 feet. The *Cory 52206* cited here varies from the typical form of the species toward var. *Schulzii.*

Atascosa Co., *C. L. Lundell 11924* (N); *E. J. Palmer 9768* (Du). Bexar Co., *G. L. Fisher s.n.* [San Antonio, July 11, 1921] (Hp, Vt); *Groth 50* (It); *Headley s.n.* [April 15, 1907] (I); *Metz 62* (Hp, I, Se), *65* (I), *s.n.* [October 23, 1933] (I); *E. J. Palmer 9190* (Du); *H. B. Parks 2524* (Au). Brewster Co., *Cutler 4779* (N); *Ferris & Duncan 2987* (Du); *G. L. Fisher s.n.* [Marathon, July 11, 1927] (Bt); *C. L. Lundell 13276* (Sm); *C. H. Mueller s.n.* [July 12, 1932] (Au, Va); *L. T. Murray s.n.* [Garden Springs, May 21, 1928] (It); *Nelson & Nelson 5108* (Au); *Shinners 8709* (Sm); *Warnock 66*, in part (Au), *20675* (Au), *20689* (Au), *W.288* (Au); *Wiegand & Wiegand 1988* (It). Burnet Co., *H. Gentry 18* (Au). Cameron Co., *R. Runyon 2088* (N), *s.n.* [Brownsville, 1930] (Hp). Coke Co., *E. J. Palmer 11159* (Du). Comal Co., *Lindheimer 275* (Ka), *1070* (Br, Me, Me, Me, Me, Ok). Concho Co., *J. Reverchon s.n.* [Curtiss 1965*] (I, It, Vt). Culberson Co., *U. T. Waterfall 4629* (N), *5091* (Au, N), *5458* (N, Sm). Dallas Co., *J. Reverchon s.n.* [Aug. '77] (It). Frio Co., *Griffen & Barkley 13909* (Au). Gillespie Co., *Strandtmann 169* (Au). Houston Co., *S. M. Tracy 9144* (It). Hudspeth Co., *U. T. Waterfall 4963* (N, Sm). Jeff Davis Co., *F. A. Barkley 14T837* (Au); *Ferris & Duncan 2703* (Du); *Hinckley s.n.* [July 16, 1936] (N); *Lundell & Lundell 10256* (Ld); *Moore & Steyermark 3029* (Du); *Tracy & Earle 184* (Cm, It). Kinney Co., *Mearns 1463* (Du). Kleberg Co., *J. F. Sinclair s.n.* [Kingsville, Spring, 1940] (Au). La Salle Co., *C. L. Lundell 14521* (N); *Mauermann 2* (Au), *21* (Au). Llano Co., *Lundell & Lundell 9028* (Ld); *Strandtmann s.n.* [Sept. 7, 1938] (Au); *Tharp s.n.* [8–17–40] (Pl, Sm). Mason Co., *Nelson & Nelson 5195* (Au). Mitchell Co., *R. W. Pohl 5095* (Sm); *Tracy 8308* (Cm). Pecos Co., *McVaugh 7321* (Sm); *Tharp 43–794* (Al, Au). Presidio Co., *Hitchcock & Stanford 6811* (N, Pl, Po, Se); *McVaugh 7441* (Sm); *M. S. Young s.n.* [Sept. 7, 1914] (Se). Reeves Co., *V. L. Cory 52206* (N). Travis Co., *C. C. Albers 32018* (Au); *F. A. Barkley 13432* (Au); *Letterman 390*, in part (Du, Ka), *s.n.* [Austin, July, 1882] (Al); *R. H. Painter 29* (Ka); *Tharp s.n.* [Austin, 7/25/41] (Pl, Se, Sm). Uvalde Co., *M. E. Jones 28537* (Du). Val Verde Co., *M. E. Jones 26234* (Du, Du); *W. H. Rhoades s.n.* [Delrio, Aug. 1932] (Hs). Zavalla Co., *Wright & Wright s.n.* [April 2, 1925] (It). County undetermined. *A. S. Hitchcock s.n.* (Ka); *Lindheimer 502* (Br, Ka).

ALOYSIA LIGUSTRINA var. SCHULZII (Standl.)Moldenke.

Texas collectors describe this plant as a slender shrub, 3–5 feet tall, with gray bark, slender erect branches, and fragrant flowers, the corolla white or tinged with pink. It has been found in shrubby grassland transition, in scrub, on foothills, grassy hillsides, low ridges, ravines, rocky stream beds, talus slopes of basaltic cliffs, shrubby fields, prairies, canyons, and arroyos. It has been collected at 4000 feet elevation. The *Ferris & Duncan 2979*, cited here, merges toward the typical form of the species.

Brewster Co., *Warnock 66*, in part (Au). Cameron Co., *Ferris & Duncan 3211* (Du); *C. L. Lundell 10685* (N); *Lundell & Lundell 9995* (Ld). Hidalgo Co., *Clover 10*, in part (Du, Me); *Lundell & Lundell 9869* (Ld). Jeff Davis Co., *D. S. Correll 14036* (Sm). Jim Hogg Co., *C. L. Lundell 11958* (N, Si). Jim Wells Co., *Wolcott & Barkley 16T322* (Au, N). Kinney Co., *Mearns 1320* (Du). Pecos Co., *Ferris & Duncan 2979* (Du); *Hinckley s.n.* [June 30, 1941] (Au); *Tharp 43–793* (Au). Presidio Co., *O. M. Clark 4764* (Ok); *Hinckley 1676* (Sm); *C. H. Muller 8431* (Sm). Travis Co., *Letterman 390*, in part (Du). Val Verde Co., *Cory 39092* (Au); *G. L. Fisher 32233* (Po); *Munz 1446* (Po); *Rollins &*

Chambers 2781 (Du). Webb Co., *M. E. Jones 29184* (It). Zapata Co., *Lundell & Lundell 12451* (N).

BOUCHEA SPATHULATA Torr.

Brewster Co., *H. C. Hanson 718* (Ka); *Moore & Steyermark 3446* (Du).

BOUCHEA LINIFOLIA A. Gray.

Presidio Co., *Tharp s.n.* [Marfa, July, 1928] (Sm). Val Verde Co., *Cory 41687* (Au).

PRIVA LAPPULACEA (L.) Pers.

Cameron Co., *Cory 36620* (Au), *36621* (Au), *36622* (N); *A. M. Davis s.n.* [Palm Grove, Sept. '41] (Au); *C. L. Lundell 12466* (Sm).

CITHAREXYLUM BERLANDIERI B. L. Robinson.

Texan collectors describe this plant as a shrub 1–6 meters tall, with stems to 1 inch in diameter, found in timber belt on leeward side of clay dunes, in forests, and in scrub on low ridges. Cory reports the vernacular name "orcujuela."

Cameron Co., *Clover 1237* (Du); *Cory 36624* (N), *51396* (Sm); *Ferris & Duncan 3051* (Du); *G. L. Fisher 41195* (Hp); *C. L. Lundell 10715* (N); *Lundell & Lundell 8643* (Ld), *8668* (Ld), *10001* (Ld); *Owens & Parks R. 1713* (Au), *R.1714* (Au); *I. Shiller 659* (Au); *Tharp 1852* (N). Willacy Co., *Tharp 1227* (N), *1249* (Bt, N).

CITHAREXYLUM SPATHULATUM Moldenke & Lundell.

Citharexylum brachyanthum var. *glabrum* C. L. Hitchc. & Moldenke in Fedde, Repert. 37: 218 (1934).

This species was discussed in the *Flora of Texas* under the name *C. brachyanthum* var. *glabrum*, but has subsequently been found to be worthy of specific rank. A description of the plant and a discussion of its differences from *C. brachyanthum* may be found in Contrib. Univ. Mich. Herb. 8: 82 83 (1942). Texan collectors describe the plant as a slender shrub, 3 5 feet tall, openly and diffusely branched, with long and slender flexible branches and orange-red fruit, globose in shape, 6–7 mm. in diameter, borne in November. It has been found in scrub, on gravel hills, and in brush on sandy plains.

Hidalgo Co., *Lundell & Lundell 9953* (Ld—isotype, Mi—type), *12689* (N, Si), *12774* (N). Starr Co., *Lundell & Lundell 12676* (N). Zapata Co., *Lundell & Lundell 12664* (N).

DURANTA REPENS L.

Texan collectors describe this plant as a thorny shrub, 2.5 6 meters tall, with drooping racemes, the corollas lavender, the 2 upper petals with purple mid-veins, the throat white, the fruit beaked, shining yellow or bright orange. Cory reports the common name "golden dewdrop."

Dallas Co., *Whitehouse 17389* (N). Harris Co., *Cory 50755* (Sm), cultivated. Hidalgo Co., *Lundell & Lundell 12775* (Sm), cultivated.

DURANTA REPENS var. ALBA (Masters) L. H. Bailey.

Hidalgo Co., *Cory 36181* (N), cultivated.

CALLICARPA AMERICANA L.

Texan collectors describe this plant as a simple- or many-stemmed shrub, 1–3 meters tall, the stems arched-divergent, with few long branches, the corollas lavender, light pink, pink, or pale pinkish-lavender, the fruit purple, cerise-purple, or rose-violet. It has been found in sand, on river terraces, in blackland prairies, on open dry slopes, in ravines in pinelands, rich woods, mixed forests, low sandy ground, sandy woods, deep sand among live oak, post oak, blackjack, and hickory in creek bottoms, and "common" in open oak woods. Muller reports the common name "French mulberry."

Aransas Co., *Cory 45742* (Au). Bastrop Co., *Lundell & Lundell 10348* (Ld). Bexar Co., *A. A. Heller 1832* (Se); *Metz 273* (Se). Comal Co., *Lindheimer 297* (Ka), *1067* (Me, Me, Me). Dallas Co., *Dapprich 7776* (Sm); *C. L. Lundell 13930* (N); *Ruth 1333* (Sm); *Shinners 8482* (Sm). De Witt Co., *C. H. Muller 8028* (Sm); *M. Riedel s.n.* [6–3–42] (Au). Fayette Co., *Forshey s.n.* [Rutersville, 1857] (Ka). Freestone Co., *Lundell & Lundell 12939* (N). Grayson Co., *Whitehouse 17487* (N). Gregg Co., *C. L. York s.n.* [Fall, 1937] (Au). Hardin Co., *Lundell & Lundell 11537* (N). Harris Co., *Armer s.n.* [Houston, July 1927] (Sm); *Boon 341* (Au), *378* (Au, N); *G. L. Fisher s.n.* [Houston, Sept. 14, 1930] (Bt), *s.n.* [Herb. Banker 2307] (N). Jasper Co., *Correll & Correll 12536* (Sm); *Cory 49833* (Sm). Nacogdoches Co., *Crausley s.n.* [July 18, 1944] (Au); *Lundell & Lundell 9615* (Ld), *9653* (Ld). Polk Co., *Girvin 101* (Au). Robertson Co., *F. A. Barkley 13590* (Au). Shelby Co., *H. B. Parks, Jr., 2310* (Au). Tarrant Co., *Whitehouse 16158* (N). Travis Co., *Krodel 35* (Au, Au); *McKee & Wesley 3860* (Au); *R. H. Painter s.n.* [Austin, 8/6/23] (Ka); *R. B. Payton 54* (Au); *Ripperton & Barkley 14524* (Au); *Strandtmann s.n.* [July 17, 1941] (Au); *Tharp 44416* (Au), *s.n.* [Austin, 7–21–40] (Pl, Se), *s.n.* [Austin, 4–31–41] (Sm); *York & Wolf 46* (Au). Trinity Co., *Goodrum s.n.* [June, 1936] (Au). Van Zandt Co., *Whitehouse 16452* (N). Victoria Co., *Ferris & Duncan 3258* (Du). Washington Co., *C. C. Albers 32022* (Au); *Brackett 253* (Au), *s.n.* [7/1/39] (Au).

CALLICARPA AMERICANA var. LACTEA F. J. Muller.

Texan collectors describe this plant as a shrub, 3 feet tall, with milky-white fruit in September, growing in pine forests.

Chambers Co., *G. L. Fisher s.n.* [Anahuac, Sept. 18, 1931] (Du). Jasper Co., *C. L. Lundell 11890* (Sm).

VITEX AGNUS-CASTUS L.

Texan collectors describe this plant as a dense shrub 2–5 meters tall, with ascending to erect branches, aromatic foliage, and lavender-blue or bluish-purple corollas, cultivated in partial shade in blackland clay.

Dallas Co., *Lundell & Lundell 9352* (Ld), cultivated; *Shinners, 8582* (Sm), cultivated. Maverick Co., *C. C. Albers 38005* (Au). Real Co., *Cory 34773* (N). Tarrant Co., *Ruth 993* (Ka, St). Travis Co., *F. A. Barkley 13081* (Al); *Barkley & Copeland 71* (N); *Dapprich 8468* (Sm), cultivated; *Harpin, Waldorf, & Barkley 13081* (Au); *Herb. Univ. Texas s.n.* [Austin, 8 14 19] (Au); *Tharp s.n.* [Austin, 8/20/41] (Sm), cultivated. County undetermined, *C. C. Albers 32019* (Au), cultivated, *41003* (Au), cultivated; *I. Shiller 870* (Au), cultivated.

VITEX AGNUS-CASTUS var. ALBA West.

In the *Flora of Texas* I stated that this variety was to be expected in

the state. Since that was written a specimen has been collected there. The label does not state that the plant was cultivated, so I assume that it was from an escaped or naturalized specimen.

Travis Co., *Mc Kee & Wesley 3896* (Au).

VITEX AGNUS-CASTUS f. ROSEA Rehd.

In the *Flora of Texas* I stated that this color form was to be expected in the state. Since that was written a specimen has been collected there, but from a cultivated plant. It was blooming in June.

Dallas Co., *Lundell & Lundell 9351* (Ld), cultivated.

CLERODENDRUM INDICUM (L.) Kuntze.

County undetermined, *Drushel, Tharp, & Barkley 13A163* (Au), cultivated.

CLERODENDRUM FRAGRANS var. PLENIFLORUM Schau.

When I prepared my discussion of this family for the *Flora of Texas* this plant had not been recorded from Texas. Since that time a specimen has been collected, but from a cultivated plant. This variety, however, escapes from cultivation very readily and has already naturalized itself in five counties of Florida as well as throughout the West Indies and tropical America. It is to be expected that it will eventually escape also in Texas.

Gonzales Co., *Cory 29602* (Au), cultivated.

TETRACLEA COULTERI A. Gray.

Texan collectors describe this plant as branched underground and at the base, 1.5–4 dm. tall, with greenish-white corollas, infrequent on stony ridges and hills and common in chaparral clumps and sandy flats. It has been collected at an elevation of 4900 feet.

Brewster Co., *Cory 53126* (Sm); *Whitehouse 11476* (Sm). El Paso Co., *Whitehouse 8750* (Sm). Presidio Co., *Hinckley 1056* (N, Sm). Tom Green Co., *Bray 345* (Sm). County undetermined, *C. Wright 458*, in part (Du).

TETRACLEA COULTERI var. ANGUSTIFOLIA (Woot. & Standl.) A. Nels. & Macbr.

Texan collectors describe this plant as a perennial herb with a fleshy rootstock, gray-green foliage, the corollas ivory-colored or yellowish, the lobes pinkish. It has been found along roadsides, in sandy flats, shrubby grassland transition, foothills, and commonly on rocky slopes.

Brewster Co., *Lundell & Lundell 14210* (N). Culberson Co., *U. T. Waterfall 3765* (N), *4457* (N); *Whitehouse 16883* (Sm). Presidio Co., *Lundell & Lundell 14289* (Sm); *C. H. Muller 8412* (Sm). Terrell Co., *Lundell & Lundell 14183* (N).

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A PRELIMINARY SURVEY OF THE DISTRIBUTION OF TEXAS PTERIDOPHYTA

DONOVAN S. CORRELL

This paper is a preliminary survey of the distribution of the Pteridophyta of Texas. It represents the data regarding distribution thus far assembled in my work on the ferns and fern allies for C. L. Lundell's *Flora of Texas*. It was considered advisable to publish such a report considerably in advance of the contemplated completion of this research so as to make this information available to botanical collectors. In the meantime, it is my hope that this will be a guide in their search for further species and additional distribution data regarding Texas ferns, and that interested parties will inform me of any additions to the fern flora or of any exceptional distribution data.

The basis for this report is not only my own collections but those in several large herbaria, as well as most of the local herbaria in Texas. I have not had an opportunity to study the collections in the Missouri Botanical Garden Herbarium upon which were based some of the early writings regarding Texas ferns. Also, several other large herbaria have collections yet to be studied. It is possible that when this work is undertaken additional valuable data will be uncovered.

Several papers concerned solely with the ferns and fern allies of Texas have been published. In April, 1903, Reverchon recorded 66 ferns and fern allies from the state. In June of the same year, Bush published an annotated list of 57 species and varieties. In 1919, Palmer cited 48 species and varieties, based upon his own collections and observations. Later, in 1927 and 1930, Palmer published papers which included, in part, his discoveries in the Davis and Chisos Mountains of ferns new to the United States or Texas. Cory and Parks' Catalogue of 1937 included 112 species and varieties. Although several species given in the above papers, especially that of Cory and Parks, later proved to be referable to other species or should be omitted because they doubtfully belong in the flora of Texas, the number included in each paper is not greatly affected.

Unquestionably, the most complete and accurate list of the Pteridophyta of Texas was compiled, but never published, by G. M. Soxman, whose fine herbarium is deposited in the Herbarium of the University of Texas. Soxman's list, as he states, includes 107 species, varieties and forms

under 151 different names. It is based on herbarium specimens and literature relative to the ferns of Texas. From my findings and interpretations, 2 of Soxman's species, *Cheilanthes microphylla* and *Dryopteris ludoviciana*, and 1 form, *Polypodium vulgare* forma *pygmaeum*, are excluded from my list. Also, 2 varieties, *Dryopteris augescens* var. *Lindheimeri* and *Selaginella pilifera* var. *Pringlei*, and 1 form, *Cheilanthes horridula* forma *compacta*, are reduced to synonymy. This, according to my findings, would place Soxman's number of pteridophytes occurring in Texas at 101 species, varieties and forms.

During the summer of 1946, my wife, Dr. Helen B. Correll, and I collected extensively throughout Texas under the auspices of Southern Methodist University primarily for the purpose of obtaining collections of pteridophytes. On this trip we obtained 573 collections which represent 74 species, 2 varieties, and 4 forms. As shown by fig. 14, we traveled and collected more or less in all the plant zones of Texas. In some instances we repeated our route so as to obtain specimens in proper season. The Rio Grande Plains was given least attention because of the apparent paucity of ferns in that region. An opportunity was thus afforded me through this

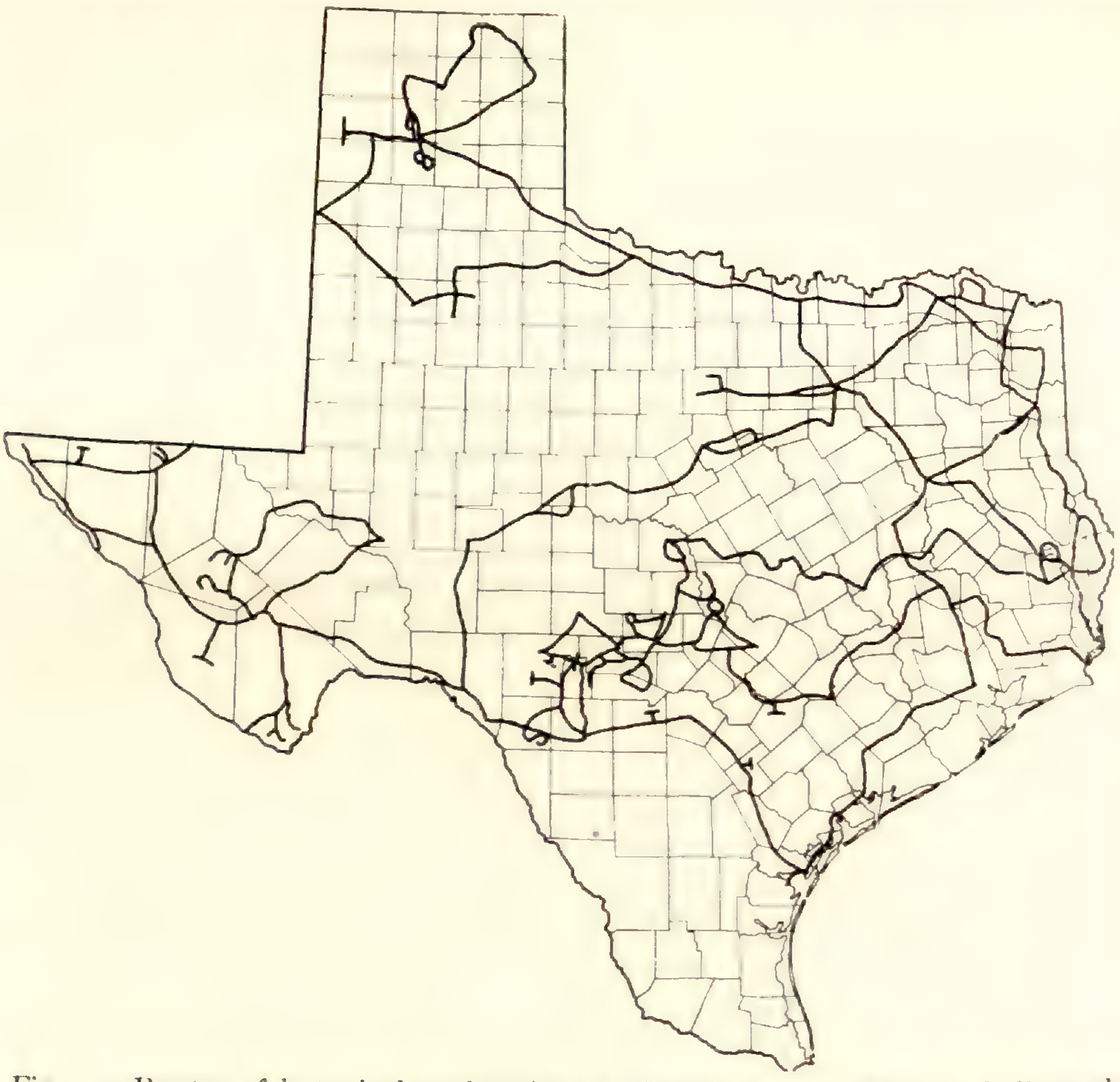

Fig. 14. Routes of botanical exploration by Correll in 1946. The dark lines chart the routes.

trip to make observations and to study pteridophytes in the field, as well as to supplement the already existing collections. Although large sections of the country were explored, the map shows that, from our standpoint, enormous regions could still be explored to advantage.

As the results of our exploration in Texas and my study thus far of specimens in various herbaria, the fern and fern allies flora of Texas is now represented by 95 species, 14 varieties, 9 forms, and 1 putative hybrid, making a total of 119 entities in 10 families and 32 genera. Several are here reported from Texas for the first time and one, *Lycopodium carolinianum*, although previously reported from Texas probably represents the first collection from the state. All new additions and comments concerning them are noted where the species are dealt with in the text.

Texas, with an area of 267,339 square miles, has an enormous diversity in topography, soil, rainfall, climate, and other ecological factors. Great areas of central and west Texas are arid or semi-arid, with an annual rainfall of 30 inches or less, most of which is precipitated in the form of local, often torrential, showers during the summer and autumn months. Dry periods of several weeks or even months occur during parts of the year. In this region, a large proportion of the pteridophytes are found in crevices of rocks, and are well adapted to withstand long periods of drought.

Fig. 15, which designates the rather well defined major plant zones occurring in Texas, is adapted from Cory and Parks (1937). Although many species occur in two or more of these plant zones, each zone has a sufficiently large number of plants peculiar to its area to set it apart from the others. These zones not only differ in varying degrees in floral composition but they all have characteristic topographic, geologic and to some extent climatic factors. Unique distribution of plant life in these zones is found in the pteridophytes as well as in all other floral groups.

The Timber Belt (Zone 1) is characterized by extensive pine and hardwood forests with intermittent swamps and cultivated land, and represents the most mesophytic area in Texas. For the most part it is a rolling country with numerous streams feeding into several large rivers, an ideal habitat for terrestrial ferns. Very few prominent rock outcrops occur. The most notable are the sandstone ridge formation which extends from Newton and Jasper counties, northwestward through Tyler and Angelina counties to Cherokee County, and the ferruginous rock formation in Morris County and vicinity. The ferns are primarily terrestrial and of eastern affinity, being most prominently represented by such typically eastern species as *Athyrium asplenioides*, *Asplenium platyneuron*, *Onoclea sensibilis*, *Lorinseria areolata*, *Polystichum acrostichoides*, *Osmunda cinnamomea*, and *O. regalis* var. *spectablis*. Several lithophilous species occur on the rock outcrops.

The Coastal Prairies (Zone 2) lie within 50 or 70 miles of tidewater along the Gulf and are characterized by level grasslands, low flat woodlands along the streams, swamps, fresh and salt marshes, and coastal sand-dunes. The few ferns found in this region are mostly terrestrial.

The Rio Grande Plains (Zone 3) are characterized by a mesquite bush country of a flat or slightly rolling nature, which attains its highest elevation in the northwest. It is a rolling plain with open prairies in some of the

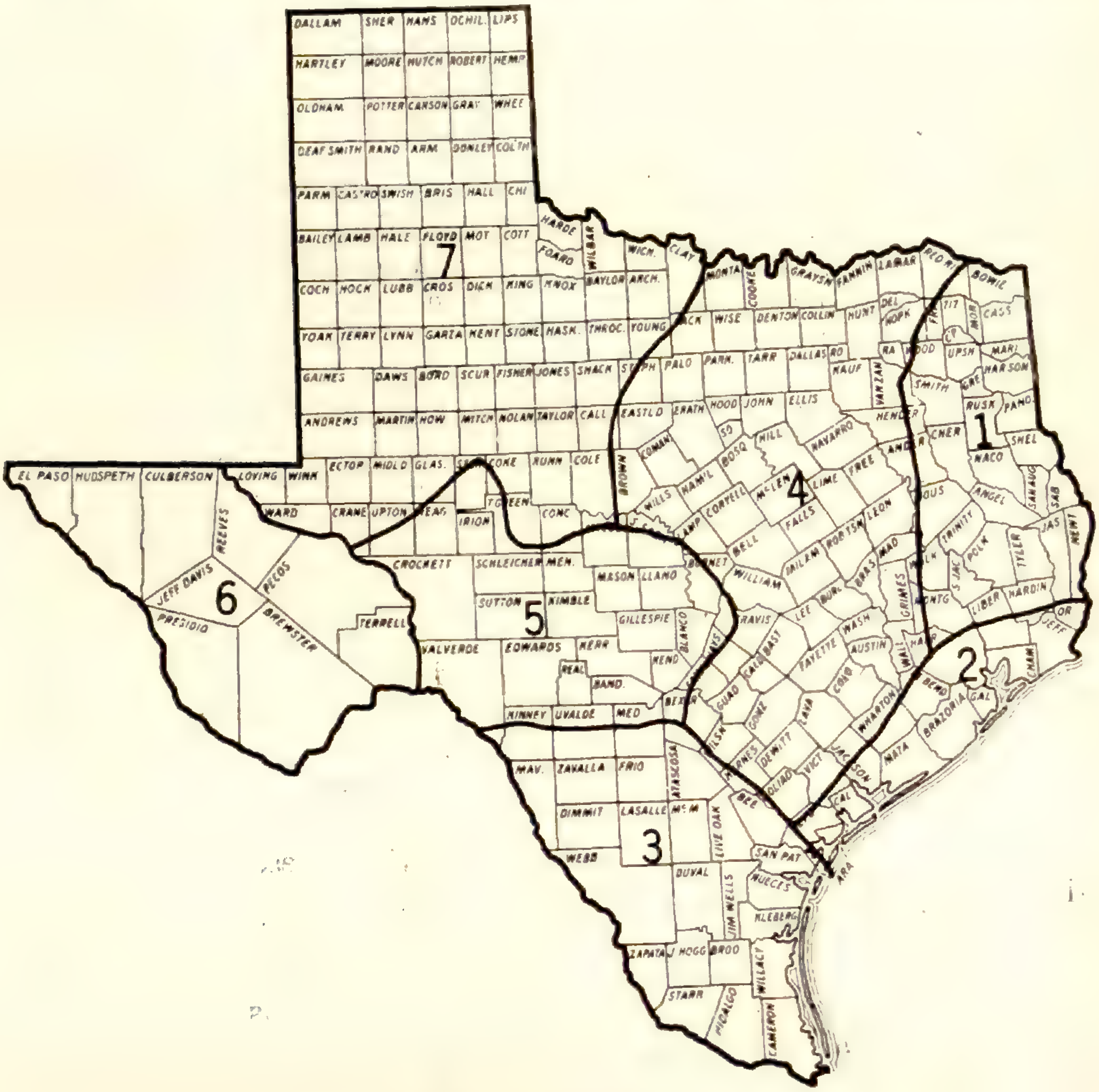

Fig. 15. Plant Zones

1. Timber Belt
2. Coastal Prairies
3. Rio Grande Plains
4. Blackland Prairies
5. Edwards Plateau
6. Trans-Pecos
7. Plains Country

upper portions, but usually covered with a heavy growth of mesquite, scrub oaks, chaparral, cacti, and other small trees and shrubs.

The Blackland Prairies (Zone 4)[1] comprise the blackland and adjacent woodland areas of central Texas, including the Grand Prairie and two broad strips of post oak woodlands running from north to southwestward on each side of the blacklands, known as East and West Cross Timbers.

[1]The term "Blackland Prairies" is used in this paper as an abbreviation for "Blackland [North Central] Prairies and Adjacent Woodlands."

Ferns are uncommon here as in most prairie country. However, in the northwestern part of this zone is found some elevated rocky country, especially in Palo Pinto County and vicinity, and there are additional scattered prominent rock outcrops throughout the zone which support quite a few rock-inhabiting species.

The Edwards Plateau (Zone 5) is for the most part an elevated, semi-mountainous, rolling or broken and irregular limestone region with a number of deep spectacular canyons cutting through the Balcones Escarpment on the south. However, in the eastern portion the so-called "granite district," comprising Burnet, Llano and Mason counties, is characterized by extensive mountainous granite outcrops. Although geologically dissimilar from the rest of the region, this district is included for convenience as a part of the Edwards Plateau. The Cedar Brakes and part of the Mesquite Belt occur in this zone, and are characterized by cedars, scrub oaks and mesquite. Because of the many large canyons and rugged terrain, this area is botanically of much interest and has consequently been visited by many botanical collectors. The ferns here are primarily lithophilous, being represented mainly by various species of *Cheilanthes*, *Notholaena*, and *Pellaea*.

The Trans-Pecos (Zone 6) includes the only true mountain regions in Texas. The region is of low rainfall. In consequence, the various mountain ranges support on their slopes a xerophytic vegetation. However, on the higher summits, valleys, and slopes where a more mesophytic environment exists are found forests of conifers and hardwoods. The numerous mountain ranges have been only partially explored, if at all. The Guadalupe Range in Culberson County comprises the southernmost extension of the Rocky Mountain mass. The ferns of this area are almost wholly lithophilous. Although we perhaps know more about the ferns of the Chisos Mountains in Brewster County and the Davis Mountains in Jeff Davis County, there is little doubt that these, as well as the entirely unexplored ranges, will produce additional species of ferns, particularly of Mexican affinity, when further field exploration is undertaken.

The Plains Country (Zone 7) or Staked Plains, as they are commonly called, covers a vast area of northwestern Texas. Tremendous stretches of flat or only slightly rolling land are to be found here. The region is composed of two rather distinct plains, the highest being farthest west. The eastern plain drops several hundred feet rather abruptly and irregularly from the western plain to leave large exposed rock faces and ledges, called "rim rock," a favorite habitat for a few of the ferns occurring in the Plains Country. Palo Duro Canyon in Randall and Armstrong counties, and the breaks of the Canadian River to the north also provide excellent habitats for the few ferns found in the Plains Country. On the whole, however, this region, like the Coastal Plains country, is essentially a fernless area.

Fig. 16 summarizes in a graphic form our knowledge thus far of the distribution of species by counties. Each dot represents a species or variety found within a particular county. It reveals not only the regions of dense and sparse distribution, but also shows the regions which have been botani-

cally explored in so far as ferns are concerned. The results shown on this map are probably indicative of the distribution of other plant groups—based on collecting. As is shown, the Timber Belt, Edwards Plateau, and Trans-Pecos regions contain the greatest number of species, which though

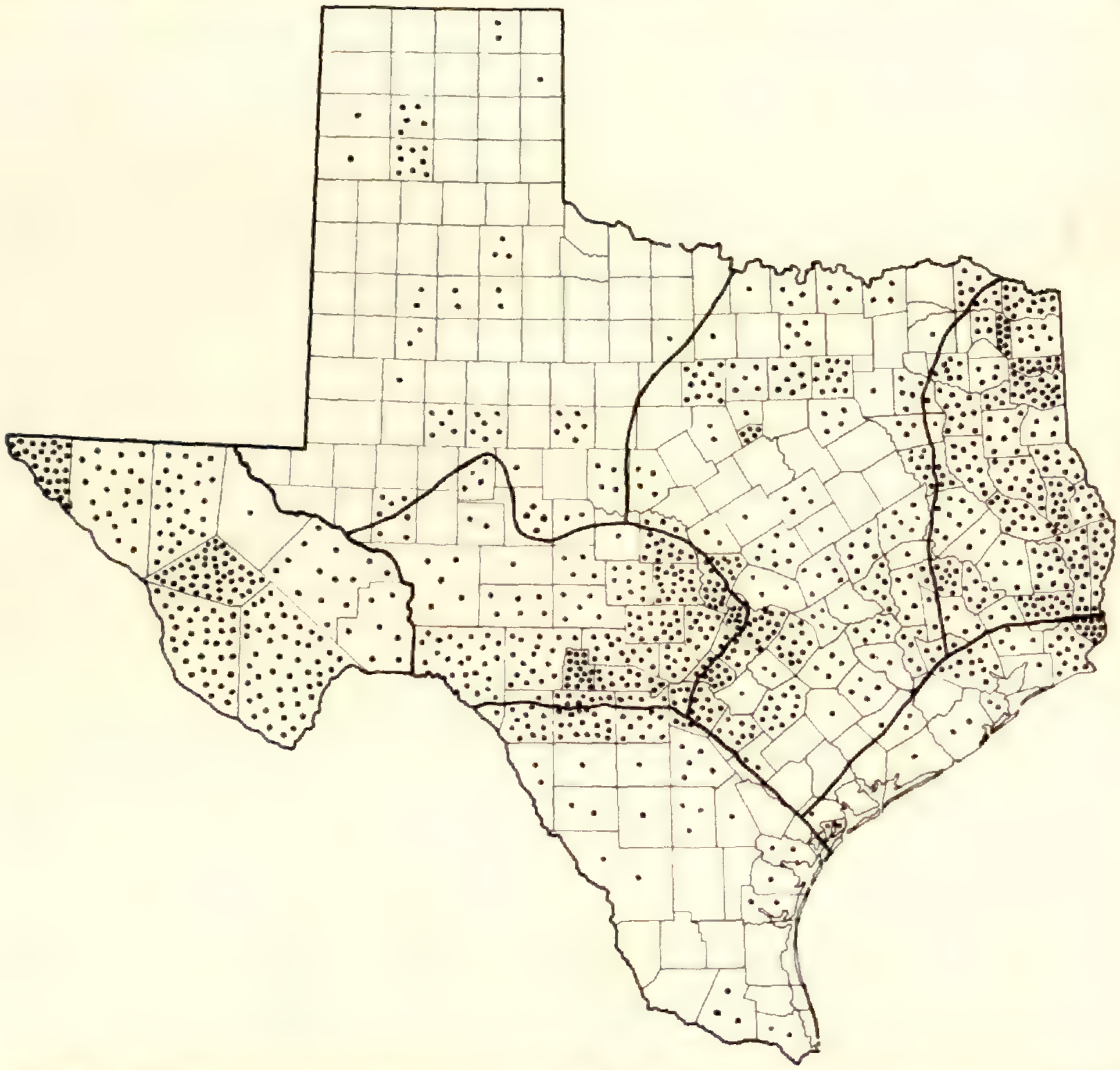

Fig. 16. Distribution of ferns and fern allies. Each dot represents a species or variety within a particular county. The dark lines outline the various plant zones.

often infrequent are more or less uniformly distributed in each section. The greatest number of species are found in Brewster County which has 49. The Plains Country and Coastal Plains have very few species of apparently sparse distribution.

The Trans-Pecos and Edwards Plateau have 30 species in common, and the Edwards Plateau and Timber Belt have 13 species in common. Only 7 species are found in all three regions just mentioned, these being *Asplenium resiliens*, *Cheilanthes alabamensis*, *C. Eatoni*, *C. tomentosa*, *Equisetum prealtum*, *Pellaea atropurpurea*, and *P. Wrightiana*. Although no one species has been found in all the plant zones in Texas, there are several which are found in 5 or 6 of the 7 zones. Those found in 6 zones are *Adiantum Capillus-Veneris*, *Asplenium resiliens*, *Cheilanthes tomentosa*, *Equisetum prealtum*, *Marsilea uncinata*, *M. vestita*, and *Pellaea atropur-*

purea. Those found in 5 zones are *Cheilanthes alabamensis, C. horridula, Dryopteris normalis, Equisetum laevigatum, Notholaena sinuata* var. *integerrima, Pellaea Wrightiana* and *Polypodium polypodioides* var. *Michauxianum*. Several species are confined to only one zone. These are discussed under the section dealing with each species.

In order to present the information regarding distribution in a convenient and immediately usable form, all of the species, varieties, and forms are listed in the table below and the plant zones in which each occurs are denoted by cross-marks (X). It is thus possible to find quickly the general distribution of each entity. Following the table is an annotated list giving in more detail the distribution of the ferns and fern allies in each plant zone and a brief description of their habitats.

Species, varieties, forms	Plant Zones (see Fig. 15)						
	1	2	3	4	5	6	7
Adiantum Capillus-Veneris		X	X	X	X	X	X
Adiantum tricholepis					X		
Adiantum tricholepis f. glabrum					X		
Anemia mexicana					X		
Asplenium Palmeri						X	
Asplenium platyneuron	X	X		X			
Asplenium resiliens	X	X	X	X	X	X	
Asplenium trichomanes						X	
Athyrium asplenioides	X	X		X			
Azolla caroliniana		X	X	X		X	
Bommeria hispida						X	
Botrychium dissectum var. tenuifolium	X	X					
Botrychium virginianum	X			X	X		
Cheilanthes aemula					X		
Cheilanthes alabamensis	X			X	X	X	X
Cheilanthes Eatoni	X			X	X	X	
Cheilanthes Eatoni f. castanea	X					X	X
Cheilanthes Feei				X	X	X	X
Cheilanthes Fendleri						X	
Cheilanthes horridula			X	X	X	X	X
Cheilanthes Kaulfussii					X	X	
Cheilanthes lanosa				X			
Cheilanthes lendigera						X	
Cheilanthes leucopoda					X		
Cheilanthes Lindheimeri			X	X	X	X	
Cheilanthes tomentosa	X		X	X	X	X	X
Cheilanthes villosa					X	X	
Cheilanthes Wootoni						X	
Cheilanthes Wrightii						X	
Cystopteris fragilis						X	
Cystopteris fragilis var. protrusa				X			
Cystopteris fragilis f. simulans						X	
Dryopteris cristata	X						
Dryopteris dentata		X					
Dryopteris Filix-mas						X	

Species, varieties, forms	Plant Zones (see Fig. 15)						
	1	2	3	4	5	6	7
Dryopteris hexagonoptera	X						
Dryopteris normalis	X	X	X	X	X		
Dryopteris thelypteris var. Haleana	X	X		X			
× Dryopteris versicolor	X	X					
Equisetum kansanum					X		X
Equisetum kansanum f. caespitosum				X		X	X
Equisetum kansanum f. variegatoides						X	
Equisetum laevigatum		X		X	X	X	X
Equisetum prealtum	X	X		X	X	X	X
Equisetum prealtum f. Drummondii				X			X
Equisetum prealtum f. texana				X			X
Isoetes lithophila					X		
Isoetes melanopoda	X	X		X	X		
Lorinseria areolata	X	X		X			
Lycopodium adpressum	X	X		X			
Lycopodium alopecuroides		X					
Lycopodium alopecuroides var. pinnatum				X			
Lycopodium carolinianum	X						
Lygodium japonicum	X	X					
Marsilea macropoda		X	X	X	X		
Marsilea tenuifolia				X	X		X
Marsilea uncinata		X	X	X	X	X	X
Marsilea vestita		X	X	X	X	X	X
Nephrolepis exaltata		X			X		
Notholaena Aschenborniana					X	X	
Notholaena aurea						X	
Notholaena candida					X	X	
Notholaena dealbata				X	X		X
Notholaena Grayi					X	X	
Notholaena Greggii						X	
Notholaena limitanea						X	
Notholaena neglecta					X	X	
Notholaena Schaffneri var. Nealleyi					X		
Notholaena sinuata			X		X	X	X
Notholaena sinuata var. cochisensis					X	X	X
Notholaena sinuata var. integerrima			X	X	X	X	X
Notholaena Standleyi					X	X	
Onoclea sensibilis	X	X		X			
Ophioglossum crotalophoroides				X			
Ophioglossum Engelmanni	X			X			
Ophioglossum nudicaule var. tenerum	X						
Ophioglossum vulgatum	X	X					
Osmunda cinnamomea	X	X		X			
Osmunda regalis var. spectabilis	X	X		X			
Pellaea atropurpurea	X		X	X	X	X	X
Pellaea cardiomorpha						X	
Pellaea glabella							X
Pellaea intermedia f. pubescens					X	X	X

Species, varieties, forms	Plant Zones (see Fig. 15)						
	1	2	3	4	5	6	7
Pellaea longimucronata						X	
Pellaea microphylla				X	X	X	
Pellaea ovata				X	X	X	
Pellaea ternifolia						X	
Pellaea Wrightiana	X		X	X	X	X	
Phanerophlebia auriculata						X	
Phanerophlebia umbonata						X	
Pilularia americana					X		
Polypodium erythrolepis						X	
Polypodium polypodioides var. Michauxianum	X	X	X	X	X		
Polypodium thyssanolepis						X	
Polystichum acrostichoides	X	X		X			
Polystichum acrostichoides f. incisum	X						
Pteridium aquilinum var. pseudocaudatum	X	X		X			
Pteridium aquilinum var. pubescens						X	
Pteris multifida	X	X					
Selaginella apoda	X	X		X	X		
Selaginella arizonica					X	X	
Selaginella Coryi						X	
Selaginella lepidophylla					X	X	
Selaginella mutica						X	
Selaginella mutica var. limitanea						X	
Selaginella mutica var. texana						X	
Selaginella neomexicana						X	
Selaginella pilifera						X	
Selaginella Riddellii	X		X	X	X		
Selaginella rupincola						X	
Selaginella Sheldoni					X	X	X
Selaginella Underwoodii						X	
Selaginella Wrightii					X	X	X
Tectaria heracleifolia					X		
Woodsia mexicana						X	
Woodsia obtusa	X			X	X		
Woodsia Plumerae						X	X
Woodwardia virginica	X	X		X			

POLYPODIACEAE. Fern Family

ADIANTUM [Tourn.] Linnaeus

ADIANTUM CAPILLUS-VENERIS L., Sp. Pl. 1096. 1753. *Adiantum modestum* Underw.

Wherever a calcareous substratum, especially limestone, and sufficient and continuously available moisture occur, this species and *Dryopteris normalis* are almost invariably found. Since this type of habitat occurs most frequently in the canyons of the Edwards Plateau, this species is exceedingly common there. It often covers the walls of limestone bluffs kept wet by seepage springs, and is common on rocks and ledges along streams.

Coastal Prairies: Harris County. This lone station occurs along a deep shaded spring branch near Houston where there is an outcrop of calcareous sandstone.

Rio Grande Plains: In four of the extreme northern border counties.

Blackland Prairies: Infrequent and of scattered distribution.

Edwards Plateau: Common, mainly in the southeastern part.

Trans-Pecos: On rocks along streams in Brewster, Culberson and Presidio Counties.

Plains Country: Infrequent in spring-fed canyons in Armstrong and Randall Counties; also in several central and southern counties.

ADIANTUM TRICHOLEPIS Fée, 8me Mém. Fam. Foug. 72. 1854-57.

On moist or dry limestone cliffs, in creeks among rocks and among boulders on open slopes, usually in partial shade.

Edwards Plateau: Medina County. Reported by Reverchon (1903) as having been collected by Bigelow in Val Verde County. Clute (Fern Bull. 12:44. 1904) also reported this species, as forma *glabrum* Clute, from the mouth of the Pecos River, where it was collected by J. H. Ferriss. I have not seen this collection.

ASPLENIUM Linnaeus

ASPLENIUM PALMERI Maxon, Contr. U. S. Nat. Herb. 13: 39. 1909.

On moist shaded mountain slopes and in crevices of granite cliffs.

Trans-Pecos: Jeff Davis County. Rare in the Davis Mountains.

ASPLENIUM PLATYNEURON (L.) Oakes ex D. C. Eaton, Ferns N. Am. 1: 24. 1878. *Asplenium ebeneum* Ait.

Although Palmer (1919) states that this species is widely distributed in both eastern and western Texas, I find that it occurs only in the Timber Belt, Coastal Prairies and Blackland Prairies regions.

Most frequent in sandy loam on rich wooded banks and slopes along streams and on the edge of flooded woodlands; also on hummocks in swamps, rotting logs, talus slopes, boulders, ledges, and in thickets; rarely semiepiphytic.

Timber Belt: Generally distributed and frequent.

Coastal Prairies: Brazoria and Orange counties.

Blackland Prairies: Generally distributed but of local occurrence.

ASPLENIUM RESILIENS Kunze, Linnaea 18: 331. 1844. *Asplenium parvulum* Mart. & Gal.

In crevices of cliffs, boulders or ledges of limestone, granite or in calcareous soils, usually in shaded but dry situation.

Timber Belt: Angelina County.

Coastal Prairies: Orange County. This is of rather unusual occurrence. The species was doubtless found on shell mounds.

Rio Grande Plains: In several extreme northern counties.

Blackland Prairies: In several western counties.

Edwards Plateau: In the southern and eastern sections.

Trans-Pecos: Rather generally distributed but not common.

ASPLENIUM TRICHOMANES L., Sp. Pl. 1080. 1753.

In moist sheltered crevices of cliffs, ledges and cavernous places in rocks.

Trans-Pecos: Jeff Davis County. Rare in the Davis Mountains.

ATHYRIUM Roth

ATHYRIUM ASPLENIOIDES (Michx.) Eat., Man. 122. 1817. *Athyrium filix-femina* of authors, not (L.) Roth; *Asplenium asplenioides* (Michx.) D. C. Eaton ex Chapman.

In sandy bogs or moist sandy woods, swamps, wet thickets and on stream banks.

Timber Belt: Generally distributed and rather common.
Coastal Prairies: In several northern border counties.
Blackland Prairies: In several eastern border counties.

BOMMERIA Fourn. ex Baillon

BOMMERIA HISPIDA (Mett.) Underw., Bull. Torr. Bot. Club 29: 633. 1902. *Gymnopteris hispida* (Mett.) Underw.

On rocky slopes, in crevices of bluffs and on ledges, usually in moist leaf mold under low shrubs.

Trans-Pecos: In the southern and western counties.

CHEILANTHES Swartz

CHEILANTHES AEMULA Maxon, Contr. U. S. Nat. Herb. 10: 495. 1908. *Cheilanthes Moritziana* of authors, not Kuntze.

On shaded banks, on ledges in canyons, in cavities under overhanging rocks, and in rock crevices.

Edwards Plateau: Comal and Val Verde counties.

CHEILANTHES ALABAMENSIS (Buckl.) Kunze, Linnaea 20: 4. 1847.

On limestone hillsides, in rock crevices and under protecting ledges, often associated with *Pellaea atropurpurea*.

Timber Belt: Walker County.
Blackland Prairies: In several western and southern counties.
Edwards Plateau: Common and generally distributed.
Trans-Pecos: In the central and southern parts.
Plains Country: Concho and Upton Counties in the extreme south.

CHEILANTHES EATONI Baker in Hook. & Baker, Syn. Fil. 140. 1867. *Cheilanthes tomentosa* var. *Eatoni* (Baker) Davenp.

On ledges and talus slopes, bluffs and about boulders in thinly wooded areas.

Timber Belt: Morris County. The occurrence of this species so far from the Edwards Plateau is unique. My wife and I found it growing on ferruginous rocks and ledges in Daingerfield State Park.
Blackland Prairies: Wilson County in the extreme southwest.
Edwards Plateau: Gillespie, Llano, Mason, and Val Verde counties.
Trans-Pecos: Common and generally distributed.

CHEILANTHES EATONI Baker forma **castanea** (Maxon) Correll, comb. nov.
Cheilanthes castanea Maxon, Proc. Biol. Soc. Wash. 32: 111. 1919.

When extremes of typical *C. Eatoni* and forma *castanea* are found they are so distinctive that one would immediately consider them to be specifically different. Unfortunately, very little material of extreme f. *castanea* exists in herbaria. An overwhelming amount of material does exist, however, which grades into one or the other of these two forms. It is simply an arbitrary matter as to which category they should be relegated. I have placed all plants which have all or part of their fronds tending to be glabrescent on the upper surface of their segments into f. *castanea*. I have designated those plants with segments hoary and densely tomentose above as the typical form.

Habitat same as that of the typical form.

Timber Belt: Morris County. It occurs with the typical *C. Eatoni* on rocks in the Daingerfield State Park. This is an exceedingly isolated locality.

Trans-Pecos: Central part, especially in Brewster County where some plants collected in the Chisos Mountains are strikingly different from typical *C. Eatoni*.

Plains Country: Mitchell County.

CHEILANTHES FEEI Moore, Ind. Fil. 38. 1857. *Cheilanthes lanuginosa* Nutt. ex Hooker; *C. gracilis* (Fée) Mett.

In dry crevices of boulders, cliffs and ledges of limestone or calcareous sandstone, usually exposed to intense sunlight.

Blackland Prairies: Palo Pinto County.

Edwards Plateau: In the central and southern parts.

Trans-Pecos: Rather frequent and generally distributed.

Plains Country: Generally distributed. This is perhaps the most widespread and abundant fern in this part of Texas.

CHEILANTHES FENDLERI Hook., Sp. Fil. 2: 103, pl. 107 B. 1858.

In rock crevices and at the base of boulders, in shaded canyons and on dry wooded banks.

Trans-Pecos: Hudspeth and Jeff Davis counties. Rare and of local occurrence.

CHEILANTHES HORRIDULA Maxon, Am. Fern Journ. 8: 94. 1918. *Pellaea aspera* Baker in Hooker & Baker; *P. aspera* forma *compacta* Clute; *Cheilanthes horridula* forma *compacta* (Clute) Broun; *C. aspera* Hook., not Kaulf.

At the time of his death, Dr. Maxon had on loan all of my collections of this species from the Edwards Plateau. He had noted that this material differed from typical *C. horridula* of the Trans-Pecos in having hairs on the upper surface of the pinnules which were longer, more slender and less pustulate, and he was of the opinion that it might be specifically or varietally different. I have since studied this and other material from the Edwards Plateau with Dr. Morton and we have concluded that although it is somewhat atypical it is not sufficiently distinct to be segregated.

In sheltered or exposed crevices of limestone or sandstone, where the plants are usually so firmly imbedded that they are difficult to collect intact.

Rio Grande Plains: Maverick and Webb counties, along the Rio Grande; also in the extreme northern border counties.

Blackland Prairies: Palo Pinto County.

Edwards Plateau: Rather frequent and generally distributed.

Trans-Pecos: In the southeastern half.

Plains Country: Concho and Upton counties in the extreme southern part.

CHEILANTHES KAULFUSSII Kunze, Linnaea 13: 145. 1839.

In crevices of rock ledges and among boulders on hillsides.

Edwards Plateau: Llano County. This is the first record of this species east of the Trans-Pecos country.

Trans-Pecos: Brewster and Jeff Davis counties.

CHEILANTHES LANOSA (Michx.) D. C. Eaton in Torr., Rept. U. S. & Mex. Bound. Surv. 2: 234. 1859.

On dry rocky slopes and ledges of sandstone.

Blackland Prairies: McLennan County. Only one locality known for Texas.

CHEILANTHES LENDIGERA (Cav.) Sw., Syn. Fil. 128. 1806.

In crevices on cliffs and boulders.

Trans-Pecos: Brewster County. Rare in the Chisos Mountains.

CHEILANTHES LEUCOPODA Link, Fil. Sp. Hort. Berol. 66. 1841.

On exposed limestone slopes and ledges on hills, mountainsides and in canyons.

Edwards Plateau: Edwards, Real and Uvalde counties.

CHEILANTHES LINDHEIMERI (J. Sm.) Hook., Sp. Fil. 2: 101, *pl. 107* A. 1858.

On dry shaded boulders and rock ledges, among talus rubble, in canyons, and on bluffs and cliffs.

Rio Grande Plains: McMullen County.

Blackland Prairies: Palo Pinto County.

Edwards Plateau: In the southeastern part.

Trans-Pecos: In the southern and western parts.

CHEILANTHES TOMENTOSA Link, Hort. Berol. 2: 42. 1833.

In clefts of ledges or boulders, on wooded hillsides, usually on sandstone, granite or siliceous rocks.

Timber Belt: Tyler and Walker counties.

Rio Grande Plains: Atascosa County, in the extreme northeastern part.

Blackland Prairies: Rather generally distributed but of local occurrence.

Edwards Plateau: Southeastern part.

Trans-Pecos: Southern half.

Plains Country: Mitchell County, in the extreme south.

CHEILANTHES VILLOSA Davenp., Cat. Davenp. Herb. Suppl. 45. 1883.

In dry crevices of limestone ledges, cliffs and boulders, or among granite boulders.

Edwards Plateau: Val Verde County.
Trans-Pecos: Generally distributed but uncommon.

CHEILANTHES WOOTONI Maxon, Proc. Biol. Soc. Wash. 31: 146. 1918.
In dry rocky places, often at the base of boulders.

Trans-Pecos: El Paso, Jeff Davis and Presidio counties. Rare and of local occurrence.

CHEILANTHES WRIGHTII Hook., Sp. Fil. 2: 87, pl. 100 A. 1858.
On exposed talus slopes, in crevices of boulders and in rocky ravines.

Trans-Pecos: In the southern and western sections.

CYSTOPTERIS Bernhardi

CYSTOPTERIS FRAGILIS (L.) Bernh., Neu. Journ. Bot. Schrad. 1^2: 26, pl. 2, f. 9. 1806. *Filix fragilis* (L.) Gilib.
In sheltered crevices in cliffs, on moist banks and wooded talus slopes.

Trans-Pecos: Culberson and Jeff Davis counties. It is also represented in Culberson County by forma *simulans* Weatherby.

CYSTOPTERIS FRAGILIS var. PROTRUSA Weatherby, Rhod. 37: 373. 1935.
On banks in oak forest.

Blackland Prairies: Gonzales County.

DRYOPTERIS Adanson

DRYOPTERIS CRISTATA (L.) Gray, Man., ed. 1, 631. 1848.
In marshes, bogs, swamps, thickets and meadows, and on springy wooded slopes.

Timber Belt: Bowie County. A sterile frond of this species is mounted on a Gray Herbarium sheet with a sterile frond of *Osmunda cinnamomea*. They were collected on the edge of a bog near Texarkana by E. J. Palmer.

DRYOPTERIS DENTATA (Forsk.) C. Chr., Danske Vid. Selsk. Skr. VIII, 6: 24. 1920. *Dryopteris parasitica* of authors, not (L.) Kunze.
On rocky wooded slopes, on hummocks in swamps, and along wooded streams.

Coastal Prairies: Harris County.

DRYOPTERIS FILIX-MAS (L.) Schott, Gen. Fil. Pl. 67. 1834.
In cool rocky mountain woods, on shaded talus slopes, and ravine walls and ledges.

Trans-Pecos: Jeff Davis County. Rare in the Davis Mountains.

DRYOPTERIS HEXAGONOPTERA (Michx.) C. Chr., Ind. Fil. 270. 1905. *Phegopteris hexagonoptera* (Michx.) Fée.
On sandy wooded slopes and in ravines along streams, and on the margin of bogs.

Timber Belt: San Augustine County. Only one station known for this species in Texas.

DRYOPTERIS NORMALIS C. Chr., Ark. för Bot. 9[11]: 31. 1910. *Dryopteris patens* of authors, not (Sw.) Kuntze; *D. normalis* var. *Lindheimeri* (A. Br.) C. Chr.; *D. augescens* (Link) C. Chr. var. *Lindheimeri* (A. Br.) Broun; *Nephrodium patens* of authors, not (Sw.) Desv.

On the edge of sandy creeks, in deep canyons, on wet bluffs and ledges, in swamps and woods, and at the base of dripping limestone bluffs. This species is practically always associated with *Adiantum Capillus-Veneris*.

Timber Belt: In the eastern and southern sections, especially in the south.
Coastal Prairies: In the central and eastern parts.
Rio Grande Plains: In the extreme northern counties.
Blackland Prairies: Mostly in the southern part.
Edwards Plateau: In the southern and eastern sections.

DRYOPTERIS THELYPTERIS (L.) Gray var. Haleana (Fern.) Broun ex Weatherby, Am. Fern Journ. 26: 95. 1936. *Nephrodium thelypteris* of authors, not Linnaeus.

In open sandy bogs, swamps and meadows, or in open low woodlands.

Timber Belt: Harrison and Marion counties. Reported from Houston and Liberty counties by Palmer (1919).
Coastal Prairies: Jefferson County.
Blackland Prairies: Waller County.

× DRYOPTERIS VERSICOLOR (R. P. St. John) Broun, Index N. Am. Ferns 82. 1938; Brown & Correll, Ferns and Fern Allies La. 59. 1942.

In our work on Louisiana ferns, Brown and I regarded those plants whose characters appeared to have been derived from both *Dryopteris dentata* and *D. normalis* as putative hybrids of those species. Plants which fall in this category have been collected in eastern Texas. They occur in similar habitats to those of their putative parent species.

Timber Belt: Jasper and San Jacinto counties.
Coastal Prairies: Orange County.

LORINSERIA Presl

LORINSERIA AREOLATA (L.) Presl, Epim. Bot. 72. 1851. *Woodwardia areolata* (L.) Moore; *W. angustifolia* J. Sm.

In sandy bogs or low sandy woods, swamps, marshes, on seepage slopes or along streams.

Timber Belt: Generally distributed and rather common.
Coastal Prairies: In the eastern part.
Blackland Prairies: In several eastern and southern counties.

NEPHROLEPIS Schott

NEPHROLEPIS EXALTATA (L.) Schott, Gen. Fil., pl. 3. 1834.

This species has escaped from cultivation and has apparently become established in several localities in Texas. It is hardy out-of-doors in Orange, where lawns are sometimes covered by its long, lanceolate fronds.

In open or dense woods, on limestone ledges and on hummocks in swamps; commonly epiphytic.

Timber Belt: Nacogdoches County.
Edwards Plateau: Real County.

NOTHOLAENA A. Braun

NOTHOLAENA ASCHENBORNIANA Klotzsch, Linnaea 20: 417. 1847.
On rocky slopes and in deep limestone canyons.

Edwards Plateau: Val Verde County.
Trans-Pecos: Brewster and Culberson counties.

NOTHOLAENA AUREA (Poir.) Desv., Mém. Soc. Linn. Paris 6: 219. 1827.
Notholaena bonariensis (Willd.) C. Chr.; *N. ferruginea* Desv.
On talus slopes and in crevices of ledges and cliffs, on canyon walls and about the base of boulders.

Trans-Pecos: In the western and southern parts.

NOTHOLAENA CANDIDA (Mart. & Gal.) Hook., Sp. Fil. 5: 110. 1864.
On limestone ledges and in crevices of canyon walls and bluffs, on open rocky slopes, at the base of cap-rock and about boulders.

Edwards Plateau: In the central and southern parts.
Trans-Pecos: Brewster County.

NOTHOLAENA DEALBATA (Pursh) Kuntze, Am. Journ. Sci. II, 6: 82. 1848.
Pellaea dealbata (Pursh) Prantl; *Notholaena nivea* var. *dealbata* (Pursh) Davenp.
This species is a borderline case in that it could be just as well placed in the genus *Pellaea* as in *Notholaena*.
In dry crevices on cliffs and boulders of limestone and other calcareous rocks, usually in partial shade.

Blackland Prairies: Ellis County and several other western border counties.
Edwards Plateau: In the eastern part.
Plains Country: Reported by Palmer (1919) from Cole County.

NOTHOLAENA GRAYI Davenp., Bull. Torr. Bot. Club 7: 50. 1880.
On talus slopes, in rock crevices and rocky barrens of granite or limestone.

Edwards Plateau: Burnet and Uvalde counties.
Trans-Pecos: Brewster and Presidio counties.

NOTHOLAENA GREGGII (Mett.) Maxon, Contr. U. S. Nat. Herb. 17: 606. 1916. *Notholaena Pringlei* Davenp.
In exposed crevices of rocks.

Trans-Pecos: Brewster County. The lone station is in Boquillas Canyon.

NOTHOLAENA LIMITANEA Maxon, Am. Fern Journ. 9: 70. 1919.
On limestone ledges and in talus rubble at the base of limestone cliffs.

Trans-Pecos: Brewster County. Rare in the Chisos Mountains.

NOTHOLAENA NEGLECTA Maxon, Contr. U. S. Nat. Herb. 17: 602. 1916.
In dry crevices of limestone ledges and cliffs, and on rocky slopes.

Edwards Plateau: Val Verde County.
Trans-Pecos: Brewster County.

NOTHOLAENA SCHAFFNERI (Fourn.) Underw. var. NEALLEYI (Seaton) Weatherby in Johnston, Journ. Arn. Arb. 24: 315. 1943. *Notholaena Schaffneri* of authors, not (Fourn.) Underwood.
On exposed or partially shaded rock ledges.

Edwards Plateau: Val Verde County, vicinity of the Devils River.
Trans-Pecos: Reported by Bush (1903) from Presidio County.

NOTHOLAENA SINUATA (Lag.) Kaulf., Enum. Fil. 135. 1824.
On dry gravelly slopes, about boulders, on rock ledges, and in crevices of low cliffs.

Rio Grande Plains: Atascosa and McMullen counties, and in several northern border counties.
Edwards Plateau: Generally distributed and fairly common.
Trans-Pecos: Generally distributed and rather frequent.
Plains Country: In several extreme southern counties.

NOTHOLAENA SINUATA var. COCHISENSIS (Goodding) Weatherby in Johnston, Journ. Arn. Arb. 24: 314. 1943.
In rubble of open dry mountain slopes, exposed talus slopes. in dry crevices of bluffs and cap-rock.

Edwards Plateau: Sterling and Uvalde counties.
Trans-Pecos: Generally distributed and frequent.
Plains Country: Northward to Motley County; sparsely distributed.

NOTHOLAENA SINUATA var. INTEGERRIMA Hook., Sp. Fil. 5: 108. 1864.
In rock crevices of ledges, boulders and bluffs, and on talus slopes.

Rio Grande Plains: Maverick and Webb counties, along the Rio Grande.
Blackland Prairies: Palo Pinto County and in the extreme southwest corner.
Edwards Plateau: Rather generally distributed and frequent.
Trans-Pecos: Generally distributed and frequent.
Plains Country: Northward to Motley County; sparsely distributed.

NOTHOLAENA STANDLEYI Maxon, Am. Fern Journ. 5: 1. 1915. *Notholaena Hookeri* Eaton.
On dry rock ledges, talus slopes and among and on boulders, on cliffs and canyon walls.

Edwards Plateau: Llano and Val Verde counties.
Trans-Pecos: Generally distributed and rather frequent.

ONOCLEA Linnaeus

ONOCLEA SENSIBILIS L., Sp. Pl. 1082. 1753.
In swampy open woods, sandy bogs, moist depressions, along streams and on the edge of lakes.

Timber Belt: Generally distributed and rather common.
Coastal Prairies: Harris and Jefferson counties.

Blackland Prairies: Wilson County. Its occurrence here is rather unusual because of its isolation from the Timber Belt.

PELLAEA Link

PELLAEA ATROPURPUREA (L.) Link, Fil. Sp. Hort. Berol. 59. 1841.

This is perhaps the most widely distributed fern in Texas. It is found to a greater or lesser degree in all floral zones except the Coastal Prairies, where rock outcrops are exceedingly rare.

On rock ledges, among rocks, on cliffs, banks and talus slopes of limerock, and in open rocky woods, usually in partial shade.

Timber Belt: San Augustine and Shelby counties.
Rio Grande Plains: In several northern border counties.
Blackland Prairies: In several northern and central counties.
Edwards Plateau: Generally distributed and common.
Trans-Pecos: Rather frequent and of general distribution.
Plains Country: Of sparse though general distribution.

PELLAEA CARDIOMORPHA Weatherby in Johnston, Journ. Arn. Arb. 24: 309. 1943. *Pellaea cordata* (Cav.) J. Smith, not Fée.

In shallow cavernous places in cliffs, on wet bluffs and in crevices and on ledges of canyon walls.

Trans-Pecos: Brewster, Jeff Davis and Presidio counties. Rare and of local occurrence.

PELLAEA GLABELLA Mett. ex Kuhn, Linnaea 36: 87. 1869.

This is apparently the first report of this species from Texas.
In crevices of cliffs and on ledges of limestone or calcareous sandstone.

Plains Country: Potter County. My wife and I found a large colony of this species on a limestone outcrop along John Rey Creek.

PELLAEA INTERMEDIA Mett. ex Kuhn forma PUBESCENS (Mett.) Broun, Index N. Am. Ferns 132. 1938. *Pellaea intermedia* of authors, not Mett. ex Kuhn; *P. intermedia* var. *pubescens* Mett. ex Kuhn.

On dry rocky slopes and ledges of limestone, cliffs and about boulders.

Edwards Plateau: Val Verde County.
Trans-Pecos: Rather frequent and generally distributed.
Plains Country: Upton County, in the extreme south.

PELLAEA LONGIMUCRONATA Hook., Sp. Fil. 2: 143, *pl. 115* A. 1858.

Among dry rocks, in shelter of boulders and in crevices of cliffs.

Trans-Pecos: El Paso and Hudspeth counties. Rare and of local occurrence.

PELLAEA MICROPHYLLA Mett. ex Kuhn, Linnaea 36: 86. 1869. *Pellaea pulchella* of authors, not Fée.

On limestone ledges in gorges and canyons, and on high limestone hills, face of cap-rock, in shaded or exposed situations. Reputedly poisonous to sheep.

Blackland Prairies: Brazos County. This station represents an unusual extension of range from the west.

Edwards Plateau: In the northern and western parts.
Trans-Pecos: Frequent and generally distributed.

PELLAEA OVATA (Desv.) Weatherby, Contr. Gray Herb. 114: 34. 1936.
Pellaea flexuosa (Kaulf.) Link.

On dry ledges and talus slopes of limestone or calcareous rocks, on or at the base of cliffs, in rich soil in open woodlands.

Blackland Prairies: Palo Pinto County and in several extreme southwestern border counties.
Edwards Plateau: In the southern and eastern counties.
Trans-Pecos: Brewster and Terrell counties.

PELLAEA TERNIFOLIA (Cav.) Link, Fil. Sp. Hort. Berol. 59. 1841.

On shaded talus slopes and ledges, in the protection of boulders and shrubs.

Trans-Pecos: Brewster County. Although reported from other localities in Texas, this species is apparently confined to the Chisos Mountains, where it is rare. Reports from outside the Chisos Mountains are based on specimens of *P. Wrightiana*, which this species closely resembles.

PELLAEA WRIGHTIANA Hook., Sp. Fil. 2: 142. 1858.

In crevices of ledges, shelter of boulders and on rocky ridges, usually in exposed situations.

Timber Belt: Tyler County. This isolated locality is an unusual extension of range from the west. My wife and I found a number of plants on exposed sandstone boulders in the Angelina National Forest.
Blackland Prairies: Palo Pinto County, in the northwestern part.
Edwards Plateau: In the southern and eastern counties.
Trans-Pecos: Brewster, El Paso, Jeff Davis and Presidio counties.

PHANEROPHLEBIA Presl

PHANEROPHLEBIA AURICULATA Underw., Bull. Torr. Bot. Club 26: 212, pl. 360. 1899. *Aspidium juglandifolium* of authors, not Kunze ex Klotzsch.

On cool damp cliffs and in cavernous recesses in granite rocks, and under overhanging ledges in canyons.

Trans-Pecos: Brewster, El Paso and Jeff Davis counties.

PHANEROPHLEBIA UMBONATA Underw., Bull. Torr. Bot. Club 26: 211. 1899.

In cool shaded canyons in maple forests, in moist ravines and on rock ledges.

Trans-Pecos: Brewster and Jeff Davis counties.

POLYPODIUM [Tourn.] Linnaeus

POLYPODIUM ERYTHROLEPIS Weatherby, Contr. Gray Herb. 65: 11. 1922.

On cliffs of porphory rocks.

Trans-Pecos: Jeff Davis County. Rare in the Davis Mountains.

POLYPODIUM POLYPODIOIDES (L.) Watt var. MICHAUXIANUM Weatherby,

Contrib. Gray Herb. 124: 31. 1939. *Polypodium polypodioides* of authors, not (L.) Watt; *P. incanum* of authors, not Swartz.

This, the only truly epiphytic fern found in Texas, occurs on various species of trees, especially oaks, occasionally on rock ledges, boulders, and mossy banks, in moderately shady and damp locations.

Timber Belt: Generally distributed and common.
Coastal Prairies: In the eastern half.
Rio Grande Plains: Atascosa County.
Blackland Prairies: Mainly in the south-central part where it is sparsely distributed.
Edwards Plateau: Uvalde County.

POLYPODIUM THYSSANOLEPIS A. Br. ex Klotzsch, Linnaea 20: 392. 1847.

On open rocky slopes and in crevices of boulders.

Trans-Pecos: Brewster and Jeff Davis counties. Rare.

POLYSTICHUM Roth

POLYSTICHUM ACROSTICHOIDES (Michx.) Schott, Gen. Fil., pl. 9. 1834.

On rich wooded hillsides or steep shaded banks of ravines along streams, along sandy creeks and in swamps.

Timber Belt: Generally distributed and rather common, especially in the northern part; forma *incisum* (Gray) Gilbert occurs in several counties.
Coastal Prairies: In the eastern half.
Blackland Prairies: Waller County and in several eastern border counties.

PTERIDIUM Scopoli

PTERIDIUM AQUILINUM (L.) Kuhn var. PSEUDOCAUDATUM Clute, Fern Bull. 8: 39. 1900. *Pteridium latiusculum* var. *pseudocaudatum* (Clute) Maxon; *P. aquilinum* of authors, not (L.) Kuhn; *P. caudatum* of authors, not (L.) Maxon; *Pteris aquilina* var. *pseudocaudata* Clute.

In open sandy woods, sandy loam of rocky seepage slopes, and flat pinelands.

Timber Belt: Common and generally distributed.
Coastal Prairies: In the northeastern border counties.
Blackland Prairies: Mainly in the south-central counties.

PTERIDIUM AQUILINUM var. PUBESCENS Underw., Our Nat. Ferns, ed. 6, 91. 1900. *Pteridium aquilinum* var. *lanuginosum* (Bong.) Fernald.

On rocky open wooded mountain slopes, and rich banks along streams.

Trans-Pecos: Jeff Davis County. Rare on Mt. Livermore, Davis Mountains.

PTERIS Linnaeus

PTERIS MULTIFIDA Poir. ex Lam., Encyc. Bot. 5: 714. 1804.

This species has escaped from cultivation and become established in southeastern Texas.

In sandy soil in woods and on masonry.

Timber Belt: Hardin County.
Coastal Prairies: Jefferson County.

TECTARIA Cavanilles

TECTARIA HERACLEIFOLIA (Willd.) Underw., Bull. Torr. Bot. Club 33: 200. 1906. *Tectaria trifoliata* (L.) Cav.; *Aspidium trifoliatum* D. C. Eaton, not Swartz.

In limestone sink-holes and caverns in limestone bluffs. This species occurs in such sinks as the Devil's Sink-hole in Edwards County, where partial shade and protection from extremes of heat and cold exist.

Edwards Plateau: Edwards and Uvalde counties. Reported by Bush (1903) from Comal County.

WOODSIA R. Brown

WOODSIA MEXICANA Fée, Mém. Fam. Foug. 66. 1854.

On shaded or sometimes sunny rock ledges and in moist crevices of cliffs.

Trans-Pecos: In the southern and western parts.

WOODSIA OBTUSA (Spreng.) Torr., Cat. Pl. in Geol. Rept. N. Y. 195. 1840.

Among rocks or along rather dry shaded ledges, on rock outcrops and cliffs, commonly in sandstone or granite regions; also on well-drained wooded banks, talus slopes or sandy knolls in woods.

Timber Belt: Mostly in the northern and western parts.
Blackland Prairies: Generally distributed and rather frequent.
Edwards Plateau: In the eastern part.
Trans-Pecos: Reported by Palmer (1930) from Mt. Livermore, Davis Mountains, Jeff Davis County. If this report is correct it represents an isolated locality for the species.

WOODSIA PLUMERAE Lemmon, Bot. Gaz. 7: 6. 1882.

On moist shaded cliffs and ledges, talus slopes and at the base of boulders.

Trans-Pecos: In the southern and western counties.
Plains Country: Randall County. Rare and isolated from the Trans-Pecos in Palo Duro Canyon.

WOODWARDIA J. Smith

WOODWARDIA VIRGINICA (L.) J. Sm., Mém. Acad. Turin 5: 412. 1793. *Anchistea virginica* (L.) Presl.

In sphagnous bogs, swamps, moist thickets, and along streams.

Timber Belt: Rather generally distributed.
Coastal Prairies: In the extreme northeastern border counties.
Blackland Prairies: Gonzales, Lee and Milam counties.

SCHIZAEACEAE. Curly-grass Family

ANEMIA Swartz

ANEMIA MEXICANA Klotzsch, Linnaea 18: 526. 1844.

On dry partially shaded steep hillsides, banks of dry ravines, on face

or at base of cliffs and boulders, under overhanging limestone ledges in dry soil.

Edwards Plateau: In the southern and southeastern parts where it is rather common.

LYGODIUM Swartz

LYGODIUM JAPONICUM (Thunb.) Sw., Journ. Bot. Schrad. 1800[2]: 106. 1801.

In moist sandy woods, thickets and along ditches, where it has escaped from cultivation and become naturalized.

Timber Belt: Jasper County.
Coastal Prairies: Jefferson and Orange counties.

OSMUNDACEAE. Cinnamon-fern Family

OSMUNDA [Tourn.] Linnaeus

OSMUNDA CINNAMOMEA L., Sp. Pl. 1066. 1753.

In swamps, bogs, wet depressions in woods, on stream-banks, springy slopes and wet rock ledges.

Timber Belt: Generally distributed and common.
Coastal Prairies: In the extreme northeastern counties.
Blackland Prairies: In several of the eastern and southern counties.

OSMUNDA REGALIS L. var. SPECTABILIS (Willd.) Gray, Man., ed. 2. 600. 1856. *Osmunda regalis* of authors, not Linnaeus.

In bogs, moist woods, and on springy slopes, hummocks in swamps, stream banks and rocky seepage slopes.

Timber Belt: Generally distributed and common.
Coastal Prairies: In the easternmost counties.
Blackland Prairies: In several central and eastern counties.

OPHIOGLOSSACEAE. Adder's-tongue Family

BOTRYCHIUM Swartz

BOTRYCHIUM DISSECTUM Spreng. var. TENUIFOLIUM (Underw.) Farwell, Papers Mich. Acad. Sci. 3: 89. 1924. *Botrychium obliquum* of authors, not Muhl. ex Willdenow; *B. obliquum* Muhl. var. *tenuifolium* (Underw.) Gilbert.

In low wet woods, swamps, moist sandy pine woods, frequently on or about rotting wood.

Timber Belt: In several eastern and southern counties.
Coastal Prairies: Jefferson County.

BOTRYCHIUM VIRGINIANUM (L.) Sw., Journ. Bot. Schrad. 1800[2]: 111. 1801.

In alluvial or well drained woodlands, swamps and thickets.

Timber Belt: Uncommon but generally distributed.
Blackland Prairies: Dallas and Red River counties.
Edwards Plateau: Kerr County. This unusually remote locality from the Timber Belt is probably part of a floral relict area.

OPHIOGLOSSUM [Tourn.] Linnaeus

OPHIOGLOSSOIDES CROTALOPHOROIDES Walt., Flora Caroliniana 256. 1788.
Ophioglossum pusillum Nutt.

In damp pastures, moist sandy soil of open pine forest, and on grassy slopes.

Timber Belt: Reverchon (1903) reported it from Newton County.
Blackland Prairies: Bastrop and Harris counties. Very rare or, perhaps more correctly, overlooked because of its small size.

OPHIOGLOSSUM ENGELMANNI Prantl, Ber. Deut. Bot. Ges. 1: 351. 1883.

Usually found in large colonies in thin black soil on limestone barrens or ledges, rocky woodland slopes, in cedar brakes, or in clayey soil along streams.

Timber Belt: Central and western parts.
Blackland Prairies: Rather frequent and generally distributed.

OPHIOGLOSSUM NUDICAULE L. f. var. TENERUM (Mett.) Clausen, Mem. Torr. Bot. Club 19^2: 146. 1938. *Ophioglossum tenerum* Mett. ex Prantl.

On grassy slopes and in wet meadows, damp depressions in pinelands and on the edge of bogs.

Timber Belt: Hardin County. Rare.

OPHIOGLOSSUM VULGATUM L., Sp. Pl. 1062. 1753.

In moist open woods, meadows, alluvial woodlands and swamps.

Timber Belt: Harrison County. Reported by Bush (1903) from Upshur County.
Coastal Prairies: Jefferson County.

SALVINIACEAE. Salvinia Family

AZOLLA Lamarck

AZOLLA CAROLINIANA Willd., Sp. Pl. 5: 541. 1810.

On still water of swamps, ponds, lakes and in slow-moving water of streams. This species, as well as those of *Marsilea*, are probably disseminated in part by water-fowl.

Coastal Prairies: Orange, Matagorda, and several other northern border counties.
Rio Grande Plains: Cameron County.
Blackland Prairies: Dallas County and several southern counties.
Trans-Pecos: Jeff Davis and Presidio counties.

MARSILEACEAE. Pepperwort Family

MARSILEA Linnaeus

MARSILEA MACROPODA Engelm. ex A. Br., Am. Journ. Sci. II, 3: 56. 1847.

This species is apparently confined to southern Texas, where it occurs in mud or sandy soil and water of swamps, marshes, woodland bogs, ditches, streams, and on the edge of ponds and lakes.

Coastal Prairies: In several counties of the extreme western part.
Rio Grande Plains: Rather common and widespread.
Blackland Prairies: In the extreme southwestern part.
Edwards Plateau: In several counties in the extreme south.

MARSILEA TENUIFOLIA Engelm. ex Kuntze, Am. Journ. Sci. II, 6: 89. 1848. *Marsilea vestita* var. *tenuifolia* (Engelm.) Underw. & Cook.

On the edge of lakes, in shallow beds of creeks, and in periodically inundated depressions, particularly in old buffalo wallows.

Blackland Prairies: Travis County.
Edwards Plateau: In the extreme eastern counties.
Plains Country: Mitchell and Taylor counties, near the southern boundary.

MARSILEA UNCINATA A. Br., Flora 22: 304. 1839.

This species, unlike *M. tenuifolia* and *M. vestita*, apparently needs a constant supply of water since it is found only in or on the edge of permanent ponds, along spring branches and in shallow water of brooks, ditches and bayous.

Coastal Prairies: Aransas County, in the extreme west.
Rio Grande Plains: Dimmit County and in counties on the northern and eastern borders.
Blackland Prairies: Of general but sparse distribution.
Edwards Plateau: Val Verde County and in several of the southern and eastern border counties.
Trans-Pecos: Jeff Davis County.
Plains Country: Potter County.

MARSILEA VESTITA Hook. & Grev., Ic. Fil. 2: *pl. 159.* 1831. *Marsilea mucronata* A. Br.

This, the most widespread *Marsilea* in Texas, usually occurs in black waxy mud along streams and rivers, in and about ponds, in silt of lakes, and in ditches or depressions such as old buffalo wallows in prairies which are periodically inundated. Although a temporary pool may become powdery dry the bony sporocarps of this species remain undamaged until water again makes the depression a quagmire. Some plants closely resemble those of *M. macrocarpa*, with which it is occasionally confused. However, the solitary sporocarp readily distinguishes it from that species.

Coastal Prairies: Aransas, Galveston and Wharton counties.
Rio Grande Plains: Rather frequent and generally distributed.
Blackland Prairies: Sparsely distributed from Dallas County southward.
Edwards Plateau: In the eastern and western parts.
Trans-Pecos: El Paso and Pecos counties.
Plains Country: Lynn, Randall, Taylor and Tom Green counties.

PILULARIA Linnaeus

PILULARIA AMERICANA A. Br., Monatsb. Kön. Akad. Wiss. Berlin, 1863: 435. 1864.

In shallow temporary pools on rocky flats and depressions in clayey prairies.

Edwards Plateau: Burnet County. Rare.

EQUISETACEAE. Horsetail Family

EQUISETUM [Tourn.] Linnaeus

EQUISETUM KANSANUM Schaffner, Ohio Nat. 13: 21. 1912.

In clayey or sandy soil of prairies, sloughs, along irrigation ditches, lake-shores, on bluffs, and among grasses on marshy banks.

Blackland Prairies: Somervell County. It is represented here by forma *caespitosum* (A. A. Eaton) Broun.

Edwards Plateau: Bexar and Blanco counties.

Trans-Pecos: Represented in several southern and central counties by the typical form as well as forma *caespitosum* and forma *variegatoides* (A. A. Eaton) Broun.

Plains Country: Represented in several northern and central counties by the typical form and forma *caespitosum*.

EQUISETUM LAEVIGATUM A. Br., Am. Journ. Sci. & Arts 46: 87. 1844.

Equisetum hyemale L. var. *intermedium* A. A. Eaton.

Fig. 17. An unusual abnormality in *Equisetum prealtum*, in which nodal and spiral sheaths occur in the same plant. Left: plant collected in Tarrant County, Texas; right: close-up of lower half of plant to show detail.

On sandy banks of lakes and streams, seepage slopes, in meadows, prairies, and rocky creek beds of canyons.

Coastal Prairies: Harris County.
Blackland Prairies: In the north-central and southern parts.
Edwards Plateau: In the central part.
Trans-Pecos: Jeff Davis County.
Plains Country: Potter and Randall counties.

EQUISETUM PREALTUM Raf., Fl. Ludov. 13. 1817. Fig. 17. *Equisetum robustum* A. Br.; *E. hyemale* of authors, not Linneaus; *E. hyemale* var. *robustum* (A. Br.) A. A. Eaton; *E. hyemale* var. *affine* (Engelm.) A. A. Eaton.

Along moist sandy banks of streams, in alluvial flats and on seepage slopes.

Timber Belt: Harrison County.
Coastal Prairies: Harris County.
Blackland Prairies: Represented in the northern and southern parts by the typical form and forma *Drummondii* (Milde) Broun and forma *texana* (Milde) Broun.
Edwards Plateau: In the southern and northern regions.
Trans-Pecos: El Paso and Jeff Davis counties.
Plains Country: Randall and Taylor counties. It is also represented in Taylor County by forma *Drummondii* and forma *texana*.

LYCOPODIACEAE. Clubmoss Family

LYCOPODIUM [Dill.] Linnaeus

LYCOPODIUM ADPRESSUM (Chapm.) Lloyd & Underw., Bull. Torr. Bot. Club 27: 153. 1900. *Lycopodium alopecuriodes* var. *adpressum* Chapm.

In sandy bogs, depressions in prairies and savannahs, and in moist open pinelands.

Timber Belt: In the southern and west-central part.
Coastal Prairies: Jefferson and Orange counties.
Blackland Prairies: In several east-central counties.

LYCOPODIUM ALOPECUROIDES L., Sp. Pl. 1102. 1753.

This is apparently the first report of this species from Texas.

In bogs, sphagnous meadows and prairies, moist open pinelands, and on seepage slopes.

Coastal Prairies: Orange County.

LYCOPODIUM ALOPECUROIDES var. PINNATUM (Chapm.) Lloyd & Underw., Bull. Torr. Bot. Club 27: 155. 1900.

This is apparently the first report of this variety from Texas.

Habitat similar to that of the typical form.

Blackland Prairies: Travis County.

LYCOPODIUM CAROLINIANUM L., Sp. Pl. 1104. 1753.

In sphagnous meadows, depressions in savannahs and prairies and open moist pinelands.

Timber Belt: Jasper County. The specimens which my wife and I obtained in a savannah north of Kirbyville probably represents the first collection of this species from Texas.

SELAGINELLACEAE. Spikemoss Family

SELAGINELLA Beauvois

SELAGINELLA APODA (L.) Spring ex Mart., Fl. Bras. 1^2: 119. 1840, as "apus". *Selaginella ludoviciana* A. Br.

In sandy bogs, swamps, wet meadows, and about springs and along streams in seepage areas.

Timber Belt: In several eastern and southern counties.
Coastal Prairies: In the extreme northeastern border counties.
Blackland Prairies: Austin and Ellis counties.
Edwards Plateau: Eastern and southern parts.

SELAGINELLA ARIZONICA Maxon, Smiths. Misc. Coll. 72^5: 5, pl. 3. 1920.

On rocky slopes and boulders.

Edwards Plateau: Mason County; representing an isolated locality from the Trans-Pecos.
Trans-Pecos: Brewster, Culberson and Presidio counties.

SELAGINELLA CORYI Weatherby, Am. Fern Journ. 36: 51. 1946.

On large boulders and ledges.

Trans-Pecos: Brewster and Jeff Davis counties.

SELAGINELLA LEPIDOPHYLLA (Hook. & Grev.) Spring, Mém. Acad. Brux. 24^1: 72. 1850.

On dry limestone ledges and bluffs, around and in the protection of boulders and on rocky slopes.

Edwards Plateau: Crockett, Uvalde and Val Verde counties.
Trans-Pecos: Rather frequent and of general distribution.

SELAGINELLA MUTICA D. C. Eaton ex Underw., Bull. Torr. Bot. Club 25: 128. 1898.

In crevices of shaded cliffs and ledges.

Trans-Pecos: Confined to several southern and western counties.

SELAGINELLA MUTICA var. LIMITANEA Weatherby, Journ. Arn. Arb. 25: 414. 1944.

On shaded rocky hillsides and crevices of cliffs and ledges.

Trans-Pecos: El Paso and Jeff Davis counties.

SELAGINELLA MUTICA var. TEXANA Weatherby, Journ. Arn. Arb. 25: 414. 1944.

On shaded rocky hillsides and in crevices of cliffs.

Trans-Pecos: Brewster County.

SELAGINELLA NEOMEXICANA Maxon, Smiths. Misc. Coll. 72^5: 2, pl. 1. 1920.

On dry rock ledges, cliffs and canyon walls, slopes and boulders.

Trans-Pecos: El Paso and Presidio counties. Rare.

SELAGINELLA PILIFERA A. Br., Ind. Sem. Hort. Berol. App. 1857: 20. 1857.

Selaginella Pringlei Baker; *S. pilifera* var. *Pringlei* (Baker) Morton.

On rocky slopes and floors of canyons in thinly wooded areas, and in crevices of canyon walls.

Trans-Pecos: Apparently confined to several counties in the south and central parts.

SELAGINELLA RIDDELLII Van Eseltine, Contr. U. S. Nat. Herb. 20: 162, 1918.

In sandy or gravelly soil in open woods, on sunny ledges and open rocky slopes, in shallow pockets among boulders, and on high dry sandy ridges.

Timber Belt: In the southern part where it occurs along an irregular ridge of sandstone outcrops.
Rio Grande Plains: Atascosa County, in the northwest part.
Blackland Prairies: In the southern half.
Edwards Plateau: In the eastern part.

SELAGINELLA RUPINCOLA Underw., Bull. Torr. Bot. Club 25: 129. 1898.

On shaded cliffs and ledges of granite, open rocky hillsides, and in depressions on large boulders.

Trans-Pecos: Brewster, Jeff Davis and Presidio counties.

SELAGINELLA SHELDONI Maxon, Proc. Biol. Soc. Wash. 31: 171. 1918.

On rock ledges and talus slopes, edge of rim-rock, in soil or on rocks along streams, commonly forming large mats.

Edwards Plateau: In the eastern and western parts.
Trans-Pecos: Western and southern parts.
Plains Country: Mitchell County.

SELAGINELLA UNDERWOODII Hieron. ex Engelm. & Prantl, Pflanzenfam. 1: 714. 1901.

On shaded cliffs and ledges, and floors of canyons.

Trans-Pecos: Brewster and Jeff Davis counties.

SELAGINELLA WRIGHTII Hieron., Hedwigia 39: 298. 1900.

On dry rocks, open hills, exposed flat rock outcrops of limestone, and on walls of canyons, frequently forming large mats.

Edwards Plateau: Rather generally distributed and frequent.
Trans-Pecos: Central and southern parts.
Plains Country: Upton County, in the extreme south.

ISOETACEAE. Quillwort Family

ISOETES Linnaeus

ISOETES LITHOPHILA Pfeiffer, Ann. Mo. Bot. Gard. 9: 135, *pl. 16.* 1922.

In shallow depressions and temporary pools and on rock outcrops and mountains of granite.

Edwards Plateau: Burnet and Llano counties.

ISOETES MELANOPODA Gay & Durieu, Bull. Soc. Bot. France 11: 102. 1864.

In shallow ponds, old buffalo wallows, wet thickets and woods, in seasonal streams and temporary sedge-grass puddles in meadows and prairies, and in temporary pools on granite outcrops.

Timber Belt: Angelina County.
Coastal Prairies: Harris County.
Blackland Prairies: Bastrop, Dallas and Tarrant counties.
Edwards Plateau: Burnet and Llano counties.

EXCLUDED SPECIES

Athyrium Filix-femina (L.) Roth ex Mertens, Arch. Bot. 2^1: 106. 1799.

This species was perhaps first reported from Texas by Bush (1903). Misdetermined specimens of *Athyrium asplenioides* were undoubtedly the basis for this report. I have seen only one of the specimens cited by Bush; his number 985. It was typical *A. asplenioides*. Palmer's (1919) citations of this species are also referable to *A. asplenioides*. *Athyrium Filix-femina* is a northern species which has not been found south of Colorado.

Cheilanthes microphylla Sw., Syn. Fil. 127. 1806.

I have referred to *Cheilanthes alabamensis* all material from Texas previously identified as this species. It may be that I am in error here. However, it is my opinion that we do not have any collections from Texas sufficiently distinct to separate them from *C. alabamensis*.

Cheilanthes myriophylla Desv., Berl. Mag. 5: 328. 1811.

Reverchon (1903) and others reported this fern from Texas. The reports of this primarily South American species in Texas are undoubtedly based on misdeterminations of some native Texas species.

Diplazium acrostichoides (Sw.) Butters, Rhod. 19: 178. 1917. *Athyrium acrostichoides* (Sw.) Diels ex Engelm. & Prantl.

In June, 1903, Bush reported this species as having been collected by Reverchon in Wood County in the Timber Belt. However, Reverchon, who published a list of the ferns and fern allies in Texas in April, 1903, did not include this species. I have seen no specimens from farther west than West Feliciana Parish, in eastern Louisiana. It seems best to me to exclude this species from the flora of Texas until its occurrence in the state is verified.

Dryopteris ludoviciana (Kunze) Small, Ferns Southeastern States 281. 1938. *Dryopteris floridana* (Hook.) Kuntze; *Nephrodium floridanum* Hook.

This species was reported by Reverchon (1903) as having been collected by J. M. Fetherolf in Newton County in the Timber Belt. It was also reported from Texas by Cory and Parks (1937). I have not seen any specimens of this species west of East Baton Rouge Parish, Louisiana.

Dryopteris noveboracensis (L.) Gray, Man., ed. 1. 630. 1848.

Cory and Parks (1937) reported this species from the Timber Belt. I have seen no specimen from the state. Its occurrence in northeastern Texas, however, is not improbable. I have seen a specimen collected by F. L. Harvey from swamps of southern Arkansas.

Dryopteris spinulosa (O. F. Müll.) Watt var. *intermedia* (Muhl.) Underw. Our Nat. Ferns, ed. 4. 116. 1893. *Dryopteris intermedia* (Muhl.) Gray.

A specimen of *Athyrium asplenioides* in the S. M. Tracy Herbarium collected in Nacogdoches County by H. B. Parks and labeled *Dryopteris intermedia* is probably the basis for Cory and Parks' (1937) report of this northern and eastern plant in Texas.

Gymnopteris Ehrenbergiana (Klotz.) C. Chr., Ind. Fil. 341. 1905. *Gymnogramma Ehrenbergiana* Klotz.

Reverchon (1903) reported this central Mexico species from Texas. This report was undoubtedly based on misdetermined specimens of *Bommeria hispida*.

Lycopodium inundatum L. var. *Bigelovii* Tuckerm., Am. Journ. Sci. 45: 47. 1843.

A specimen of sterile moss (*Polytrichon* sp.) from Mangum Lake, Shelby County, collected by H. B. Parks and identified as this species (in S. M. Tracy Herbarium) is probably the basis for Cory and Parks' (1937) report of this northeastern plant in Texas.

Lycopodium lucidulum Michx., Fl. Bor.-Am. 2: 284. 1803.

Cory and Parks (1937) reported this species from the Timber Belt and Coastal Prairies. Undoubtedly, the report of this eastern and northern species in Texas is based on misdeterminations of some native Texas species.

Lygodium palmatum (Bernh.) Sw., Syn. Fil. 154. 1806.

A specimen of *Lygodium japonicum* in the S. M. Tracy Herbarium from Orange County, identified as *L. palmatum*, is probably the basis for Cory and Parks' (1937) report of this northern and eastern species in Texas.

Notholaena Fendleri Kunze, Farnkr. 2: 87, pl. 136. 1851.

Bush (1903) and others reported this species from Texas. I have not seen any specimen from the state. Its occurrence, however, in the Trans-Pecos is not improbable since its range extends into New Mexico.

Pellaea mucronata D. C. Eaton in Torr., Rept. U. S. & Mex. Bound. Surv. 2: 233. 1859.

Broun (1938) included Texas in the range of this species. I have, however, seen no specimen from Texas. This species is usually found on shady rock ledges and slopes.

Polypodium furfuraceum Schlecht. & Cham., Linnaea 5: 607. 1830.

Cory and Parks (1937) reported this species from the Trans-Pecos. Undoubtedly, the report of this central Mexico species in Texas is based on a misdetermination of some native Texas species.

Polypodium virginianum L., Sp. Pl. 1085. 1753.

Cory and Parks (1937) reported this species as occurring in the Blackland Prairies. I have seen no specimen from Texas. I have seen specimens, however, as far southwest as Logan County, Arkansas.

Polypodium vulgare L. forma *pygmaeum* (Schur) Broun, Index N. Am. Ferns 144. 1938.

Broun (1938) includes western Texas in the range of this variety. I have seen no specimens from Texas. However, since the typical form is found in New Mexico, its occurrence in the Trans-Pecos is not improbable.

Selaginella arenicola Underw., Bull. Torr. Bot. Club 25: 541. 1898.

This species was first reported from Texas by Reverchon (1903) as growing in sand and among rocks in the granite region of Llano County. In 1919, Palmer cites specimens from Hardin and Leon Counties. The specimen from Leon County, which I have seen, is *S. Riddellii*. Cory and Parks (1937) were the last to include this species in the flora of Texas. According to Clausen (1946), with whom I agree, this species is confined to Georgia and Florida. Reports from Texas are, for the most part, based on misdetermined plants of *S. Riddellii* which closely resembles *S. arenicola* in habit.

Selaginella densa Rydb., Mem. N. Y. Bot. Gard. 1: 7. 1900.

Cory and Parks (1937) reported this species from the Trans-Pecos. I have seen no specimen from Texas. Its occurrence in western Texas, however, is not improbable since the species is found in New Mexico.

Selaginella rupestris (L.) Spring, Flora 21: 149, 182. 1838.

Reverchon (1903) was perhaps the first to report this species from Texas, where he said it occurred on dry exposed rocks in the southwest. Later, Palmer (1919) cited specimens from the state. These specimens, however, were either misdetermined *S. Sheldoni* (Palmer 11389) or *S. Wrightii* (Palmer 10146). In 1937, Cory and Parks included this species in their catalogue of Texas plants. In 1946, Clausen gives the range of this species as only south to central Oklahoma and northern Arkansas. I do not believe this species occurs in Texas.

Selaginella tortipila A. Br., Ann. Sci. Nat. V, 3: 271. 1865. *Selaginella Sherwoodii* Underw.

Cory and Parks (1937) reported this species as occurring in the Timber Belt and Coastal Prairies. Undoubtedly, the report of this eastern Piedmont and Blue Ridge Mountains species in Texas is based on misdeterminations of some native Texas species.

POSSIBLE FUTURE ADDITIONS TO THE FERN FLORA OF TEXAS

The following species are cited merely to call the attention of collectors to the possibility of their occurrence in Texas. Thus forewarned, botanical collectors and Texas students of ferns can be on the watch for these species.

Adiantum pedatum L., Sp., Pl. 1095. 1753.

Specimens of this species have been collected near Page, Le Flore County, Oklahoma, about 60 miles north of Red River County, Texas. It is usually found on rich wooded slopes.

Asplenium pinnatifidum Nutt., Gen. 2: 251. 1818.

This species occurs on rocks near Robbers Cave, Latimer County, Oklahoma, about 60 miles north of Lamar and Red River counties, Texas. It is usually found in dry crevices of non-calcareous rocks.

Cystopteris bulbifera (L.) Bernh., Neu. Journ. Bot. Schrad. 1^2: 10. 1801.

Specimens have been collected above Gray's Ranch (Otero or Eddy County), Guadalupe Mountains, New Mexico. The Guadalupe range extends into Culberson County, Texas. This species is usually found on shaded ledges or talus slopes of limestone.

Dryopteris marginalis (L.) Gray, Man., ed. 1. 632. 1848.

This species has been found near Cache, Comanche County, Oklahoma, about 30 miles north of Wichita County, Texas. It has also been collected near Page, Le Flore County, Oklahoma, about 60 miles north of Red River County, Texas. It is usually found on shaded ledges, talus slopes or in rocky woods.

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I wish to express my appreciation to the curators of the various herbaria who have kindly cooperated in loaning me specimens. To Mr. C. A. Weatherby and Dr. C. V. Morton I am indebted for advice and assistance in determining some of the most difficult collections.

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Division of Plant Exploration and Introduction
Bureau of Plant Industry, Soils, and Agricultural Engineering
Agricultural Research Administration
U. S. Department of Agriculture

NOTES

REQUEST FOR SEED OF LOBELIA CARDINALIS

WRAY M. BOWDEN

Viable seeds of any of the four varieties of *Lobelia Cardinalis* subsp. *graminea* (Lam.) McVaugh will be much appreciated; see Ann. Mo. Bot. Gard. *27*:347. The seed should be very ripe when collected. If unripe, the plants may be dug and transferred to a convenient location, or the flowering stalks may be cut and placed in jars of water in a sunny place until ripe. An herbarium specimen from one or more of the plants from which the seed is taken will assist in identification of the material. In case the collector would like part of the material returned to him after it has been identified, extra specimens should be collected and a note attached requesting return of duplicate material. Seeds may be sent by letter; herbarium specimens should have a customs declaration form stating that the contents are "dried plant specimens, for scientific purposes only." The appearance of the pressed flowers will be much improved if a piece of waxed paper is placed against the inflorescence for the first 24-48 hours. Mail Address: Dr. Wray M. Bowden, Division of Botany and Plant Pathology, Central Experimental Farm, Ottawa, Canada.